Social intervention and audience delineation: An application of multiple discriminant function analysis

by

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A Dissertation Submitted to the
Graduate Faculty in Partial Fulfillment of
The Requirements for the Degree of
DOCTOR OF PHILOSOPHY

Department: Sociology and Anthropology
Major: Sociology

Approved:

Signature was redacted for privacy.

In Charge of Major Work

Signature was redacted for privacy.

For the Major Department

Signature was redacted for privacy.

For the Graduate College

Iowa State University
Ames, Iowa

1973

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CHAPTER I. INTRODUCTION

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The use of multiple variables to describe and explain complex behavioral phenomena has come to be generally accepted by behavioral scientists. This is evidenced by the emphasis on multivariate analysis in the papers, books and articles published in the last five years, or even the last decade. Multivariate analyses have been used as procedures for providing understanding, explanation, and/or prediction of various behavior patterns. Some well known examples in the field of sociology would include the work of Duncan (1966), Coleman (1964) and Blalock (1962). These writers and others have been interested in developing new techniques for using multivariate procedures or in modifying those procedures that are presently available. For example, Duncan (1966), Heise (1969), and Land (1969) have written in the area of path analysis. These writings represent but a small part of the recent emphasis on multivariate analysis in sociology.

The references to multivariate analysis thus far have been to scientists who have done analyses of data in which the independent and dependent variables have met certain assumptions, particularly the assumption that the variables were measured on an interval or ratio scale or at least are indicators of variables which are represented by more than a

nominal level of measurement.

There exists situations of analysis in which some independent and/or dependent variables do not exceed the nominal level. It has been indicated that these situations should not stop the sociologist from using multivariate analysis techniques. Coleman, for example, has suggested that sociologists "consider multivariate analyses using variables which are not continuous attributes but qualitative attributes" (1964: 189). Coleman further suggests that there is utility in considering noncontinuous variables in a multivariate analysis situation. Multivariate analyses using noncontinuous variables could, for example, reduce the complexity of the data to a single predictor equation. An example of the reduction of the complexity of data with continuous variables to a single predictor equation is the solution achieved in a multiple regression analysis. This same kind of reduction in complexity is seen as advantageous when considering noncontinuous variables. It can be pointed out that sociologists have been analyzing variables which are noncontinuous but for the most part this has been done using tabular analysis procedures. Hirschi and Selvin have discussed some of the disadvantages of tabular analysis (1967: 162).

Coleman also points out that there have been some efforts to provide a basis for multivariate analysis of nominal

variables. He suggests the work of Robert Somers (1959) and Fred Schreier (1957) and also points to the standard techniques of analysis of variance for "m" factors, each at two levels, which may be applied to multivariate analysis with "m" independent attributes as indicated by Maxwell (1961a).

In addition, one can find literature on computer techniques which have been developed for multivariate analysis with nominal or ordered variables. For examples of these procedures one can cite the work by Cooley and Lohnes (1962) and Morgan, David, Cohen and Brazer (1962).

When considering using multivariate analysis and the criterion of whether the variables were measured on more than a nominal level, one can be dealing with any one or combination of four different situations regarding the level of measurement of the variables.

1. Dependent variable(s) nominal, independent variables nominal
2. Dependent variable(s) nominal, independent variables more than nominal
3. Dependent variable(s) more than nominal, independent variables nominal
4. Dependent variable(s) more than nominal, independent variables more than nominal

The situation that has been chosen for consideration in this dissertation is the second situation listed--dependent variable(s) nominal, independent variables more than nominal. That is, one part of the topic for consideration in this

dissertation concerns the presentation and discussion of a multivariate analysis procedure that can be used when the researcher is analyzing data in which the dependent variable(s) is measured on a nominal level or is treated as if it were nominal and the independent variables are considered to be more than nominal. The dissertation presents a description and illustration of the use of multiple discriminant function analysis in the analysis of survey data which represent dependent variables which are categorical or in other words nominal.

Intervention problem

Multivariate analysis and level of measurement represent two of the important factors for consideration in this dissertation. The third factor is the substantive problem which concerns a question regarding the homogeneity of the rural adult smoking population.

Numerous attempts have been made over a considerable period of time to get people to stop smoking cigarettes. On the whole, these intervention attempts have been less than successful. Conferences have been held and research has been done as part of the effort to gain insights into the limited success in securing long term success for smoking cessation programs. Hochbaum raises the point of the existence of various types of smokers as an explanation of

the fact that not all attempts to change smoking behavior have been successful. If one accepts the existence of types of smokers as a possible explanation for the lack of success of smoking intervention programs there still remains the problem of identifying the "types or categories". If the categories are not based on an assumption that the variable has an underlying continuous scale there is another problem to be dealt with. That problem is the existence of a dependent variable that is nominal.

Objectives

A partial answer to the question of the existence of "types" or categories of smokers may be found in using some multivariate analysis technique which allows for analyses with a categorical dependent variable. More specifically, there are two problems that are posed for consideration in this dissertation:

1) Is the nonmetropolitan adult audience toward whom smoking intervention programs might be directed homogeneous or is it in fact represented by "sub-audiences" which are represented by more variance between than within, when a number of variables are considered simultaneously?

2) Given that the audience-audiences problem concerns a dependent variable that is represented by a nominal scale, is there a multivariate analysis technique that can be used to test the audience-audiences hypothesis?

The focus of this dissertation concerns the use of an analytical technique that has been relatively unused in sociology on a problem that represents an issue basic to all intervention programs. That basic issue concerns the decision to consider the target population as whole or to consider subpopulations separately. Thus, the dissertation has both exploratory and descriptive goals.

Dissertation Outline

In order to meet the objectives of the dissertation, the following format is used to organize the research and findings. The next or second chapter of the dissertation, the Analytical Framework Chapter, will present the specification of the research problem and the identification of an analytical procedure which can be used to provide a solution to the research problem of audience delineation.

The third chapter presents a discussion of the dependent and independent variables used in the analyses and concludes with the hypotheses to be tested. The fourth chapter provides a brief description of the study which provided the data for the analyses.

The Findings and Conclusions Chapter presents the dedescription of the results and use of the stepwise discriminant function analysis procedure and the conclusions based on

the tests of the hypotheses. The sixth and final chapter presents a brief summary of the preceding chapters.

CHAPTER II. ANALYTIC FRAMEWORK

Smoking as a Problem

History of smoking

The use of tobacco has a long history as do the attitudes and beliefs related to it. As fashion and moral codes in general have changed through time, the particular responses to tobacco usage have also changed. From early settlement of the Americas, the use of tobacco has been an increasingly fashionable practice and until the 1600's it was used with little question of its possible harmful effects.

A growing concern for its possible negative effects began to develop, however, as evidenced by King James the First's statement that the use of tobacco is "a custom loathsome to the eye, harmful to the brain and dangerous to lungs..." (Borgatta and Evans, 1968: 4). Such public figures joined by the puritans and many "ladies' of sorority" began a movement to discourage the use of tobacco. This movement, however, remained small and of little consequence until the 1940's.

Before the 1900's tobacco was used primarily in the form of cigars, chewing tobacco, pipe tobacco and snuff. It wasn't until 1870 that cigarette smoking gained popularity. This popularity was encouraged primarily by the development of a cigarette manufacturing machine which allowed large-scale production and reduced costs.

Since this development, the incidence of smoking has grown at an extremely rapid rate. Production of cigarettes rose from 5 billion in 1900 to almost 600 billion in 1970; per capita consumption of cigarettes rose from 1200 in 1925 to 4200 in 1968. At the same time, the evidence of problems related to cigarette smoking has also grown and has implicated cigarettes as a major factor in many problem areas. Some of the areas are as follows:

(1) Economic - For individuals who smoke, the cost of cigarettes can represent a sizable portion of their budget. This is especially apparent among the poor and least educated segments of the population where the incidence of smoking is greatest.

(2) Safety - The chief public safety hazard of smoking is that of fire. A high proportion of fires in homes as well as forest fires can be attributed to the failure to completely extinguish lit cigarettes or the matches used to light cigarettes.

(3) Pollution - One source of pollutants of the atmosphere is that of cigarette smoke. In certain industries, vital equipment cannot operate to full effectiveness with smoke in the air (computer industries, hospitals).

(4) Psychological Addiction - There is evidence that cigarette smoking becomes, for some smokers, a crutch or a necessary part of their life style and in this way reduces

the effectiveness of an individual by restricting his freedom (Tomkins, 1966).

(5) Health - Perhaps the most crucial problem area related to smoking is that of health. Evidence from a variety of sources concerning a number of health problems suggests that cigarette smoking is a major factor contributing to health problems. A brief list of health afflictions associated with smoking is given here. Horn has pointed out that these are the afflictions which occur significantly more often among cigarette smokers than nonsmokers (1970b: 49).

1. Cancer of the: lung, larynx, lip, oral cavity, esophagus, bladder.
2. Respiratory diseases: chronic bronchitis, emphysema.
3. Heart diseases: arteriosclerotic heart disease, coronary artery disease.
4. Others: noncoronary cardiovascular diseases, cirrhosis of the liver, ulcer of the stomach.

These health problems, in turn, bring about many related problems such as absenteeism, the need for disability compensation, and rise in health and life insurance rates. Clearly, there are a variety of problems related to smoking which, in the aggregate, have an impact on society. Among these, the health problems appear to be the most acute at this time.

Concern over smoking and health

The public concern about smoking and health remained low until the 1900's. Since that time a growing concern has been evident. Today the concern is widespread and is found, at all levels (national, state and local) and in the public and private sectors of our society. A review of the development of this concern is presented below.

The beginning of the concern over the relationship between disease and smoking is found in several isolated studies of the early 1900's. Similar isolated findings appeared in the 1930's which indicated an increase in trends of the incidence of cancer and coronary disease. These studies did not attempt to link smoking to the increase in disease but they were later used to show that as the incidence of smoking rose so did the incidence of various diseases. This type of analysis has been referred to as "retrospective" study as opposed to "prospective" study in which individuals are chosen to be observed and conclusions are reached by analysis over time of the individual's smoking behavior and disease incidence. The retrospective type of studies culminated in 1954 with the findings of Borgatta and Evans, in which cancer was linked with smoking (1968: 8). From this time on the research has been by and large of a prospective nature. Based on these retrospective studies, however, the national concern about smoking increased. During the 1950's numerous voluntary

and public organizations began to develop programs of information dissemination as well as research related to smoking. A few of these are listed here: British Medical Council; Cancer Societies of America, Denmark, Sweden, Finland and the Netherlands; American Heart Association; Joint J. B. Council of Great Britain; Canadian National Department of Health and Welfare. The U.S. Public Health Service became officially involved in 1956 when, under the Surgeon General's direction, a scientific study group on smoking and health concluded that there is a causal relationship between excessive cigarette smoking and lung cancer. In 1957 the Surgeon General made this conclusion public by his statement that "Excessive cigarette smoking is one of the causative factors in lung cancer" (1964: 7). In 1962 the Surgeon General formed an advisory committee to review all available data on smoking and the Surgeon General's comprehensive report was published in 1964. This report became the basis for the Cigarette Labeling and Advertising Act which was passed in 1965. At the same time Congress appropriated funds for the establishment of a Federal agency to continue the work begun by the advisory committee. The new agency, the "National Clearinghouse on Smoking and Health," is administered under the division of Chronic Illness of the Public Health Service.

During the same period the voluntary and professional health organizations were also active. The research sponsored

by these organizations found cancer, heart diseases and emphysema to be closely associated with smoking. The activities of these individual organizations were limited, and to more effectively contribute to the effort to reduce the incidence of smoking they formed the National Interagency Council on Smoking and Health in 1964. The Council had 16 charter members and now includes 23 member organizations (Fritschler, 1969: 122). The primary goal of this organization is to pool resources to establish and coordinate local, state and nationwide efforts to reduce the incidence of cigarette smoking.

The interest in this problem has maintained a worldwide audience as evidenced by the 1967 World Conference on Smoking and Health. Sponsored by the National Interagency Council, this meeting permitted the exchange of information and the furthering of alliances among public, volunteer, and professional organizations at the international level. Since this meeting the interest in smoking and health at the national level has been maintained and although the organizations and groups involved are quite diverse in many respects, they are united in at least one respect--they are all searching for some way to intervene to reduce the incidence of cigarette smoking.

Planned Change

Smoking behavior intervention is a specific problem that is represented in the more general area of planned social change. Planned change is a purposive or directional change. Lippitt, Watson and Westley point out that planned change is the change "that originates in a decision to make a deliberate effort to improve the system and to obtain the help of an outside agent in making this improvement" (1958: 10). They go on to specify that the decision to make the change may be made by the system itself or by an outside change agent.

In the case of smoking behavior intervention the decision made by the "system itself" is represented in a situation in which the smoker has decided he wants to stop smoking. Again, using the case of smoking behavior intervention, the decision made by "an outside change agent" would be represented in the situation in which a health organization decided that it was going to get people to stop smoking. The National Interagency Council on Smoking and Health is an example of "an outside change agent". Thus, the impetus for the planned change may be internal, that is, coming from one of four types of dynamic systems - "the individual personality, the face-to-face group, the organization or the community" as indicated by Lippitt et al. (1958: 5). Or, the impetus may be external, that is, coming from an outside change agent. It should be

noted that even if the impetus for the change is external, the change that is planned to occur will take place in one or more of the four "dynamic systems". To use the smoking behavior situation as a case in point, if the health organizations plan to change something regarding smoking behavior, that change will occur in the community, in an organization in the community, in face-to-face groups or in an individual. The planned change in any case is not intended to occur within the change agent but in one of the four systems that are the focus of the change agents planned change program.

Individual behavior change

The goal of smoking behavior intervention has its ultimate focus on the behavior of individuals. If one is to focus on the planned change of individual behavior it is necessary to have a conceptual framework that allows for consideration of the process of behavior change and to identify the nature of the change. One conceptual framework that has been used to explore the cessation of cigarette smoking and which provides insights into the process and nature of behavior change is the adoption process. Graham and Gibson (1967) and Straits (1967) have used the adoption process as a point of departure for their analysis of cigarette smokers and cigarette smoking behavior change.

Traditionally, the adoption process has been conceptual-

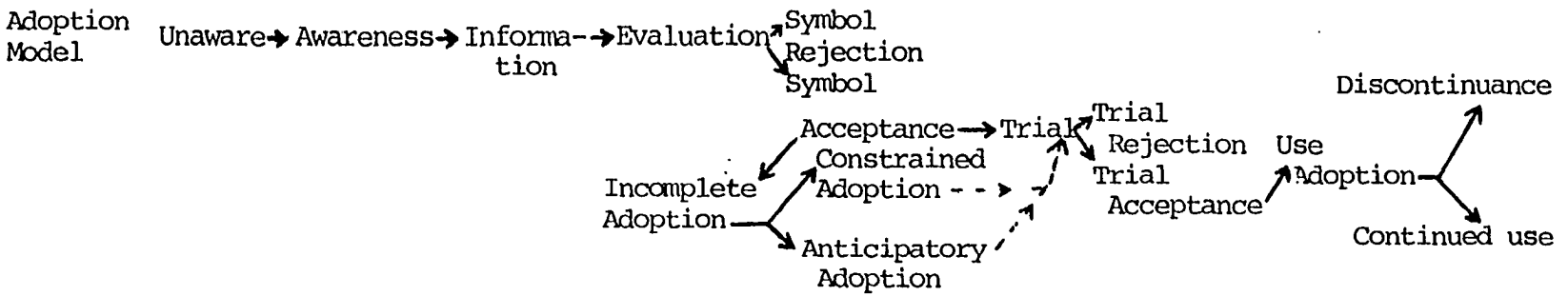
ized as a decision making process that involves a series of steps or stages. Lionberger indicates that the stages are used to represent the adoption process for it is thought that the "decision to change is the product of a sequence of events and influence operating through time" (1960: 21). The adoption process, as represented by the five stages, does not assume that all persons pass through the stages at the same rate nor that each stage is a discrete point in the process. Rather, as Lionberger points out, the stages are assumed to generally represent "a useful way of describing a relatively continuous sequence of actions, events and influences that intervene between initial knowledge about an idea, product or practice and the actual adoption" (1960: 23) or rejection of it. The stages in the adoption process are:

1. Awareness: individuals know of the existence of an idea or practice but lack details concerning its intrinsic nature and worth.
2. Information: The individual becomes interested in the idea and seeks further basic information about it.
3. Evaluation: The individual utilizes the knowledge he has about the idea and weighs the alternatives in terms of his own use. Usually, he decides to give the idea a trial.

4. Trial: The individual observes the idea in use and is concerned with specific details about the idea.
5. Adoption: The individual fully utilizes the idea and is satisfied with it (Bohlen, 1964: 269).

In his efforts to develop a model for achieving smoking cessation, Daniel Horn has indicated that there is a process whereby smoking behavior cessation takes place. According to Horn, this process "starts with a simple awareness that smoking is a health hazard then progresses through four stages: (1) to stop ignoring the problem; (2) to initiate the action to stop; (3) to achieve short-term success; and (4) to achieve long-term success, (1970a: 90). The similarity between the stages in the adoption process and the process as proposed by Horn is presented in Figure 1.

Just knowing that there is a process whereby people come to make a decision whether or not to adopt a new idea or practice or discontinue an existing practice is not sufficient for the development of a planned change or an intervention program. There are many factors which must be taken into consideration. According to Klonglan, Coward and Beal (1968) there are five major elements that are to be considered in the analysis of adoption behavior. Those elements are as follows: (1) the sponsoring agency and/or change agent, (2) the innovation that is sponsored, (3) the adoption unit



Smoking Cessation Model	Unaware →	Awareness →	Stop Ignoring the Problem			→ Try to quit →	Short Term Success →	Long Term Success
Definitions	Unaware	Initial exposure to the innovation	Interest in & seeks more info. about the innovation	Concerned applying the innovation to his own situation	Accepting the ideas	Use the product or practice on small scale to determine the utility or feasibility for his own situation	Adopt the product practice at both the idea & behavior level (if this level exists for the innovation) & decides to continue the full use of the innovation	

Figure 1. Comparison of adoption model and Horn's smoking cessation model

for whom the innovation is recommended, (4) the adoption behavior or action relative to the innovation that the adoption unit is expected to take and, (5) the adoption process through which the adoption unit passes when making decisions relative to the innovation (1968: 2).

The role of the change agent and the nature of the adoption process have been briefly discussed. The discussion which follows focuses on the innovation and the adoption behavior or action that is expected. One of the considerations that is given to innovation concerns the nature or characteristic of the innovations. Beal, Klonglan and Bohlen (1966: 2) point out that innovations may be defined as "ideas, practices, or products." It has also been pointed out by Graham and Gibson that "most innovations which have been studied in the past have been incremental, adding elements to culture..." (1967: 1). Others have indicated that in addition to studying the adding of elements of culture or behavior there is a need for a study of discontinuations (see Leuthold (1967), Bohlen (1964), Johnson and van den Ban (1959), Dautschman and Havens (1964).

In their discussion of innovations, Graham and Gibson also state that in addition to innovation being incremental, "...items long established in the culture are dropped by displacement by new elements or for other reasons. Such decremental occurrences involve change in ideas, equipment, and/or behavior" (1967: 1). Cessation of cigarette smoking is

an example of a decremental innovation.

In this discussion of types of adoption behavior and its relation to innovation, Klonglan, Coward and Beal identify a set of adoption behavior. Briefly those major types are:

1) symbolic adoption - acceptance of those innovations that have only an idea component.
2) action adoption - the acceptance of both the idea and object components for immediate use.
3) anticipating adoption - acceptance of the idea and object components for some future use (1968: 15).

The behavior that is the ultimate goal of the cessation of smoking innovation is the discontinuation of cigarette smoking. Thus, the decremental innovation - cessation of cigarette smoking - is to be followed by the action adoption of that innovation - discontinuation of cigarette smoking.

The last of the five elements Klonglan et al. (1968) have pointed out as points to be considered in the analysis of adoption behavior is the adoption unit. When the concept of adoption unit is applied to conceptualization of planned change as offered by Lippitt, et al., (1958) the conclusion is that the adoption unit can be an individual, a group, an organization and/or a community. For the purposes of this dissertation the unit that is the focal point of the analysis is the individual.

In considering the individual as the adoption unit in smoking intervention efforts one of the challenges faced by

change agents is the identification of the audience toward whom he wishes to direct efforts and activities. The audience consists of individual persons but it is known that these persons as individuals are unique. But, at the same time, some people are more like others than not. Thus, there is a dilemma that is faced by the change agent; should the people be considered individually or should they be considered as an aggregate? Considering the people individually may involve a great deal of expenditure of time and money. On the other hand, considering the people as an aggregate may be done at the expense of being ineffective with a large number of persons because of their "uniqueness". Therefore, among the factors that the researcher should consider when focusing on the adoption unit is the provision of an answer to the question "who are the people whose behavior is to be changed"? That is, what are their characteristics or, more specifically, what is the audience profile?

Audience delineation - an intervention problem

Bohlen (1964: 267) has indicated that the question that is very often asked as the guide for adoption and/or diffusion studies is "why are some individuals more receptive to new innovations than others"? Another version of the "why" question that can be asked is the question, "what characteristics or combinations of characteristics are associated with the

differential in the acceptance of cultural innovations?" That this question is important for consideration is pointed out by Beal, et al. (1966). They indicate that an adequate description of an audience is problematic to the development of the diffusion efforts and ultimately to the adoption of the innovation.

Wells and MacLean point out that the maxim usually associated with communications namely, "know your audience", is one of the more frustrating admonitions that a professional communicator faces (1962: 1). The fact that audience delineation is a problem for communication is also pointed out by Massy (1965). The problem of audience delineation provides the basis for both the practical and methodological foci of this dissertation.

The methodological portion of the problem is the exploration of the use of multivariate analysis in a situation where the dependent variable(s) is, either by choice or because of the inherent nature of the data, categorical or what can be called nominal. It should be noted that for this dissertation the selection of the methodological problem is not a capricious act on the part of the researcher. Rather, the methodological problem is related to a problem of formulating and testing propositions and to the more immediate problem of the use of sociological data. That is, the methodological problem selected for consideration is based on a "real world" problem -

smoking behavior intervention - rather than being a methodological problem which is selected just for the sake of having a problem to solve. This latter situation is usually less beneficial to all concerned in the long run than is the situation in which the methodological problem is related to a practical problem.

There are many situations in the development or application of sociological principles which may be facilitated by the solution to problems that are methodological. That is, at a general level, if one is interested in developing programs for changing behavior, one of the factors which must be considered is whether or not all of the people whose behavior is the target of change are to be treated as one homogeneous category. The decision regarding whether to treat the audience as one category or to divide the audience into categories which would be treated separately can be made solely on theoretical grounds or solely on empirical grounds. If one wishes to use empirical grounds, either alone or in combination with theoretical considerations, a procedure or procedures are needed for analyzing data so that the data can be used to make the decision regarding the categories. Such an empirically oriented procedure is thought to be advantageous when one considers the problem of cigarette smoking behavior and its effects on health (Hochbaum, 1965: 695).

The development of programs to change cigarette smoking behavior provides a practical example of the problems faced in an audience delineation situation as this relates to decision making. Or, more specifically as it relates to getting people to make the decision to discontinue cigarette smoking.

Questions such as; "should an intervention program be directed toward all cigarette smokers or should certain programs be used with certain categories of smokers?, should be asked when intervention programs are developed. In other words the problem is one of determining if there is an audience or if there are audiences that should be considered when one attempts the diffusion of an innovation such as the cessation of cigarette smoking into a target population.

The concern here is not one of determining which message should be used on the audience. This question presupposes that one has successfully delineated the audience toward whom the direction of a message might be appropriate. Rather, the issue is one of determining first if there is an audience or if there are audiences. It is only after the audience - audiences question has been settled that the question of different messages becomes relevant.

The point of using solely empirically based criteria, both empirically and theoretically based criteria, or solely theoretically based criteria to delineate audiences was

mentioned previously. In selecting one of these sets of criteria the procedure followed herein will be to describe the use of a procedure which utilizes both theoretically and empirically based criteria. The adoption stages represent the theoretical criterion whereas data from a survey represent the empirical criterion. The adoption stages can be used to identify the relative location of a person in the decision making process. Once this location of the person is known intervention programs can be mounted to attempt to move the person through the succeeding stages. But, there is a need to test the assumption that all people within an adoption stage have more in common than just being in the adoption stage with other persons.

The separation of target audience(s) may be best accomplished on the basis of a multivariate analysis in which one considers a number of independent variables together rather than considering them one or two at a time and then trying to somehow "add up" the characteristics to achieve what might be identified as a composite of tabular findings. The multiple discriminant function analysis is a multivariate procedure which goes beyond tabular analysis in handling categorical variables. Hirschi and Selvin (1967: 162) have pointed out that tabular analysis or cross-break frequency tables have limitations for multivariate analysis. First, the approach requires an increasingly large number of observa-

tions as the number of cells in the table increases. As a result, the data must be categorized into more inclusive categories as the number of variables used increases. This is necessary in order to maintain the manageability of the data. Another limitation is the fact that, as people, we are able to handle just so much data at one time and therefore while tabular analysis may be used to analyze a number of variables we are unable to comprehend the amount of data that would be presented on large size tables.

Massy has pointed out that when the similarity of audiences has been considered in the past the usual procedure has been to "collect data for each audience group on several interesting variables, compute the means of the variables, and then compare them among the audience groups (1965: 34). He indicates further that "it is difficult to look at two columns of means and decide how different, on balance they really are" and "the problem becomes more complicated when comparing three or more audiences" (1965: 39). Thus, the use of a multivariate analysis procedure overcomes the limitations of tabular analysis.

Categorical Measures

Literature regarding a number of alternative analytical procedures for dealing with nominal or categorical data were referred to in Chapter I. Before proceeding further it is thought that a brief discussion clarifying the meaning of nominal data is appropriate. A discussion of the nature of data logically begins with the topic of measurement.

S. S. Stevens, points out that generally speaking measurement "is the assignment of numerals to objects or events according to rules" (1946: 677). He also indicates that "the fact that numerals can be assigned under different rules leads to different kinds of scales and different kinds of measurement" (1946: 677). The numerals may be simply an ordered set of elements in a one-to-one correspondence with the numbers system. But number and numeral are not always interchangeable. It should be noted that numerals, by which is simply meant a group of conventional signs or marks on a piece of paper, obtain their order by convention. The distinction between numbers and numerals is important in order to make clear the significance of assigning numerals to objects without specifying which algebraic system governing operations on numbers is applicable.

Measurement is possible only because there is a certain correspondence between the empirical relations among

objects and events, on the one hand, and the rules of mathematics on the other. The formal rules and operations that represent this correspondence have been described by Stevens and have been identified as representing four types of measurement scales: nominal, ordinal, interval and ratio. One of the elementary characteristics of the numerals assigned to objects or events is that each is unique. That is, the numeral provides a different "name" that might be used to distinguish one property of objects from other properties. This characteristic is imparted to a property of objects when the property is broken up into categories. The categories may be used to classify objects. Therefore, for example, if we assume that smoking behavior is a property that people can have and that either an individual has smoked a cigarette or has not smoked a cigarette, the categories of smoker and non-smoker can be defined and people classified into one or the other of the categories. If those who have smoked are separated according to their behavior as it is related to stopping smoking, the categories of successful, unsuccessful and no attempt are appropriate. The four categories: Non-Smoker, Successful, Unsuccessful and No Attempt meet the first requirement for measurement. That requirement is that the population or "universal set", as Kerlinger (1965: 422) calls it, should be broken down into at least two subsets. He indicates that "the most elementary form of measurement would

be to classify or categorize all objects as possessing or not possessing some characteristic" (1965: 419). This situation would be an example of the lowest level of measurement - the nominal level of measurement.

The nominal level of measurement has certain characteristics. First, if numerals are assigned to objects they are numerical without having a number meaning; they cannot be ordered or added. In fact, they permit no arithmetic operations at all. Thus, many statistical writers use the word qualitative to describe nominal scales. In doing so the writers distinguish between nominal or qualitative scales and scales which are ordered quantitatively. Thus in a nominal scale the numerals have a qualitative meaning but not a quantitative meaning. The second characteristic of the nominal level of measurement is that the symbols assigned to the objects constitute nominal scales. A scale is a set of symbols or numerals so constructed that the symbols or numerals can be assigned by rule to individuals (or their behaviors) to whom the scale is applied. The assignment being indicated by the individual's possession of whatever the scale is supposed to measure (Kerlinger, 1965: 480). Therefore, a nominal scale consists of a set of categories and the basic operations of scaling.

The requirements for a nominal scale are quite simple. First, all members of a set are assigned the same numerals

or symbols. Second, no two sets are assigned the same numerals. Any two observations may be equal (in terms of the property in question) and they are therefore classified into the same category. Or, observations may be unequal which leads to their classification into different categories. Therefore, categories must be mutually exclusive and exhaustive. That is, each observation can be classified only into one category of the set and each observation can be always classified into some one of the categories of the set. It should be noted that, strictly speaking, one does not measure the object but a property of the object. In effect this means that an object or event is classified on the basis of one or a combination of its properties and very seldom on the basis of a simultaneous combination of all of the properties which constitutes the whole object or event.

One of the principles in measurement is that as one considers the levels of measurement in ascending order of the complexity of their characteristics (nominal, ordinal, interval, ratio), it can be shown that what applies to a given level of measurement (except ratio) also applies to the levels of measurement above that level. The converse of this is that all scales of measurement (except nominal) can be reduced to a lower level of measurement. But, lower levels cannot be increased to a higher level. That is, for example, an ordinal

scale can be reduced to a nominal scale but a nominal scale cannot be increased to the ordinal level. Thus, all measurement scales can be considered as nominal. It should be noted that in making this reduction of the scale, information is necessarily lost. Therefore, the reduction of scale would be undertaken advisedly.

There may be situations in which the researcher is not particularly interested in the fact that the data are measured on an ordinal or interval scale. He may be more interested in treating the objects or events as members of categories. That is, an analysis comparing those persons with hgih scores, to those with middle scores, and to those with low scores, may be his goal. Thus, the ordinal, interval or ratio level data may be treated as nominal data and other characteristics of the scales, for that analysis, may be ignored. In fact, multiple discriminant analysis can be used in analyses in which the data representing the dependent variables are at a nominal level of measurement, either as a result of the original scale or by the reduction of the original scale to one which meets only the requirements of the nominal level of measurement.

Multivariate Analysis

It has been indicated previously that this dissertation is concerned with a multivariate analysis technique. It is thought that a brief description of what is meant by multivariate analysis will provide a basis for the discussion of multiple discriminant function analysis which follows.

Multivariate analysis is generally considered to include the statistical procedures which are used to analyze multiple measurements that have been made on a number of individuals. The important distinction is that the multiple variables are considered in combination, as systems. Kendall (1957) states that in looking at the whole field of analysis, multivariate analysis has two discernible features:

a. "We are concerned with a set of 'n' individuals each of which bears the value of 'p' different variates. The multivariate character, so to speak, lies in the multiplicity of the 'p' variates, not in the size of the set 'n'.

b. "The variates are dependent among themselves so that we cannot split off one or more from the others and consider it by itself. The variates must be considered together."

Kendall also points out that the statistician is continually trying to reduce the dimensions of the analysis problem. As is often the case with the sociologist as a researcher, the statistician through the use of multivariate analysis has "an embarrassing profusion of variates and his objective is to make 'p' as small as he can" (1957: 6). In this case 'p'

refers to the number of variates. Kendall goes on to indicate that "we may thus define multivariate analysis as the branch of statistical analysis which is concerned with the relationships of sets of dependent variates" (1957: 6).

The topic of multivariate analysis can be divided into two parts according to whether the analysis is concerned with dependence or interdependence. Kendall (1957: 6) defines the dependence analysis situations as those in which:

> ...one (or more) of the variates is selected for use by the conditions of the problem and we require to investigate the way in which it depends on the other variates--the socalled but badly named 'independent' variates.

Kendall points out that the regression of one variate on others is an example of this type of analysis. It can be pointed out also that multipled discriminant function analysis is another example from the dependence class of multivariate analysis techniques.

In interdependence analysis the concern is with the "relationship of a set of variates among themselves no one being selected as special in the sense of the dependent variate" (1957: 6). Kendall points out that the analysis of functional relationships, correlation, and component analysis fall into this group.

The problem of audience delineation is an example of the dependence analysis situation. The problem identifies audiences or groupings as the dependent variable and the

characteristics as the independent variables. Moreover, the audiences are categorical or, more appropriately, measured nominally. Therefore, in order for a multivariate analysis technique to be used to analyze the audience delineation problem it must not only be of the dependence analysis type but it must be able to handle multivariate classification problems with nominal dependent variables. These criteria limit the number of specific multivariate techniques which can be used. When two more criteria are added, namely that the grouping or categories are defined "a priori" and that the purpose of the analysis is to distinguish the groups from one another on the basis of their profile scores, the alternatives are reduced further.

One of the problems faced by the researcher is the selection of an appropriate technique for analyzing the data he has collected. Not all the analysis techniques are appropriate for all kinds of data or all kinds of problems. This is no less the case for the problem of audience delineation. The two major criteria that have been identified as relevant for selecting an appropriate analysis technique have been discussed. These criteria are: (1) the level of measurement of the data - on both the dependent and independent variables, (2) the type of analysis to be used - univariate or multivariate. Within multivariate analysis the

researcher has yet another decision to make, namely, whether he is interested in dependence or interdependence analysis. Thus, the data and the research problem, along with the researcher's knowledge of available analytical techniques determine the range of techniques appropriate for the analysis. One technique which meets the requirements of the research problem considered herein and which does not exceed the limits of the data is multiple discriminant function analysis. Straits has pointed out that it can be shown that it is a multivariate technique which can be used in analyses of data in which the dependent variable is measured using no more than a nominal scale and the independent variables measured on at least an ordinal level scale (1967: 79). In addition, this analysis technique has been designed for use when the groupings are defined a priori and when one is attempting to distinguish groups from one another.

Multiple discriminant function analysis

When considering multiple variable analysis and the audience delineation problem, two questions can be asked of a set of data for several groups of people. Professor Phillip J. Rulon (1950) has pointed out that the questions are, "How can I analyze these data so I may determine the group in which an individual will perform best?" and "How can I analyze these data so I may determine the group which an individual

is most like?" The answer to the first question is that multiple regression is appropriate. The answer to the second one proposes that discriminant function analysis is an appropriate technique. The distinction that is made between the two problems posed and the respective analytical techniques suggested is that the first is a problem of selection where as the second is a problem of classification.

In describing multiple discriminant function analysis or what is referred to as N-way multiple discriminant analysis, Massy indicates that:

> The procedure attempts to "predict" which audience group an individual belongs to, based on a set of group means...together with the set of sample variances and covariances of the variables. That is, the individual is assigned to the audience group whose characteristics are most like his own. Since it is known beforehand which group the person actually belongs to, we can prepare a table of correct and incorrect classifications. This 'score sheet' of correct and incorrect classifications or confusion matrix, then provides the basis for the desired similarity indices. That is, the fewer the misclassifications of individuals to audience groups, the more distinct or dissimilar the audience groups (1965: 39).

Discussions of multiple discriminant function analysis can be found in a number of places; for example the work of Massy (1965), Straits (1967), Rettig (1964), Cooley and Lohnes (1962), and Nunnally (1967), can be indicated as a beginning, but, the list would not be complete without the papers in "The Multiple Discriminant Function - A Symposium". The first article of the symposium is by David V. Tiedman (1951). In that article,

Tiedman traces the historical development of the analytical technique from its first use in 1935 by M. Barnard to the work by R. A. Fisher in 1936 to the work by Rao in 1948 to the work by Bryan and by Lubin in 1950 in which they independently presented a generalization of discriminant analysis to the case of G groups. Tiedeman also contrasts multiple discriminant function analysis with multiple regression and in doing so presents a description of multiple discriminant analysis. Rulon (1951) presents further discussions of the distinctions between multiple discriminant analysis and multiple regression and Bryan presents a mathematical discussion of a procedure for computing the multiple discriminant function (1951).

A very concise statement describing the multiple discriminant analysis procedure is presented in "Biomedical Computer Programs" (Dixon, 1971). In regard to the description of the program for the "Discriminant Analysis for Several Groups" Dixon states that:

> This program directs the computations of a set of linear functions for the purpose of classifying an individual into one of several groups. The input data consists of a set of observations for each of the classification groups; each observation consists of the values of a set of variables, and each observation contains a value for each of the variables.
>
> The group assignment procedure followed is derived from a model of a multivariate normal distribution of observations within groups such that the covariance matrix is the same for all groups. An individual is classified into the group for which the estimated probability density is greatest. The equivalent computational procedure followed evaluates the computed linear function corresponding

> to each of the groups and assigns an individual to the group for which the value is largest. The hypothesis that group means are the same is tested (1971: 196).

In summary, the multiple discriminant analysis procedure is used when the dependent variable is categorical, the categories have been defined a priori, there are n persons, k variables, at least k categories and is a means of combining the information from those n individuals, k variables and the categories so as to discriminate between the members of the groups as well as possibly using a linear function. Nunnally indicates that the score on a discriminant function for any one individual is obtained by the formula:

$$y = a_1x_1 + a_2x_2 + \ldots + a_n x_k \qquad \text{(Formula 1.1)}$$

Where:

y = scores on discriminant function

$x_1, x_2 \ldots x_k$ raw scores on variables

$a_1, a_2, \ldots a_n$ weights for variables (1967: 391)

Reference has been made to the term "linear" in relation to discriminant analysis. This comes from Fisher's solution to the problem of two groups and discriminating between them which he proposed in 1936. Tiedeman describes Fisher's proposal as follows:

> ...consider a linear function, y_1 of the variables, $x_1 (n = 1,2,...,n)$, such that y equals $v_1 x_1 + v_2 x_2 + ...+ v_m x_n$. The total sum of squares of this linear function can then be broken up into two parts, a part with n_1 degrees of freedom which is the between means of groups sum of squares and a part with n_2 degrees of freedom which is the within groups sum of squares. The coefficients of the linear functions of the x's are chosen so that the ratio of the between means of groups sum of squares to within groups sum of squares is a maximum (1951: 74).

The linear function of the "x" variables which is used to maximize the ratio of between groups sums of squares to within groups sum of squares has been given the name discriminant function. Tiedeman goes on to state that the discriminant function, in maximizing the ratio of the between-means variances to the within groups variances has the "effect of spreading the means of the groups while at the same time reducing the scatter of the individual points about their respective means" (1951: 75). This serves to lessen the overlap of the distributions of scores for the groups or categories and also serves to reduce the number of "miscalssified individuals".

A general rule about the number of discriminant functions which can be calculated for any set of groups and variables is that the number of sets of coefficients of the linear discriminant functions that are possible is equal to the number of variables or one less than the number of groups, whichever is less. That is:

LDF = G-1 or k-1 whichever is less (Formula 1:2)

where:

LDF = number of linear discriminant functions

G = number of groups (categories in dependent variable)

k = number of variables in the problem

The first discriminant function derived is that linear combination of variables which maximizes the ratio of between-means variances to the within groups variance. The second discriminant function is derived which serves as the second-best explainer of variance and so on through the last discriminant function. One of the advantages of the discriminant function analysis as indicated by Tiedeman is that one deals only with the number of discriminant functions that is necessary to "contain entirely the points in "n" dimensional space representing the centroids of G populations" (1951: 75). Therefore, if there are "n" individuals and "k" variables, the profile for any individual can be represented by a point in a k-dimensional space. Nunnally points out that each axis of the space consists of one of the variables and the variables are depicted as orthogonal to one another (1967: 389). As such, discriminant function analysis can be used to:

1. Determine whether or not differences in score profiles for two or more groups are statistically significant.

2. Maximizing the discrimination among groups by combining the variables in some manner.

3. Establishment of rules for the placement of new individuals into one of the groups.

Formula 1.1 is used to fulfill the third listed use of discriminant analysis.

This dissertation focuses on the first and second use of discriminant function analysis in testing the proposition that "the audience toward which smoking intervention programs might be directed is not homogeneous". Massy points out that "the audience delineation problem is soluble provided that the variables are approximately normally distributed in each population, their respective variance - covariance matrices are about equal, and that the a priori probability for membership in each (i.e., the relative incidence of the groups in the overall population) is known" (1965: 41).

Stepwise analysis

The stepwise analyses not only permits a test of the hypotheses but provides a systematic procedure for reducing the plethora of variables commonly associated with studies that are based on a survey design to a more efficient and useful number.

The Stepwise Discriminant Analysis Program used (BMD07M) is a part of the Biomedical Computer Programs Package and is described in the publication "BMD Biomedical Computer Programs".

The program is described in the BMD publication as follows:

> This program performs a multiple discriminant analysis in a stepwise manner. At each step one variable is entered into the set of discriminatory variables. The variable entered is selected by the first of the following equivalent criteria:
>
> (1) The variable with the largest F value.
>
> (2) The variable which when partialed on the previously entered variables has the highest multiple correlation with the groups.
>
> (3) The variable which gives the greatest decrease in the rates of within to total generalized variance.
>
> A variable is deleted if: its F value becomes too low. The program also computes canonical correlation and coefficients for canonical variables. It plots the first two canonical variables to give an optimal two-dimensional picture of the dispersion (Dixon 1971: 241a).

In addition to performing the stepwise analysis of the data, the program calculates F values for testing differences between each pair of groups. This is provided in the F-Matrix. The program also calculates an approximate F statistic to test the equality of group means. The F matrix and the approximate F statistic will be used to test the hypotheses. Further description of the computational procedure for the Stepwise Discriminant Analysis Program is presented in Appendix A.

CHAPTER III. CONCEPTUAL FRAMEWORK

Introduction

Cigarette smoking behavior is a topic which has long been the focal point of controversy. The controversy has resulted from two almost diametrically opposed positions. One position contends that there is a high degree of physical harm which results from cigarette smoking. The opposing view contends that cigarette smoking is only slightly harmful at most. The evidence to date has been interpreted by the Public Health Service (1964) as supporting the point of view that cigarette smoking is harmful to health. By using some of the data on the effects of smoking, the belief that cigarette smoking is harmful has been advanced to the point where some of those who hold that belief feel that something should be done to reduce if not eliminate cigarette smoking. Numerous attempts have been made which have been directed towards the goals of reduction of cigarette smoking and/or the goal of eliminating cigarette smoking.

Schwartz and Dubitzky (1969) have pointed out that the attempts to change smoking behavior range from individual attempts to stop outright, with or without the use of aids, to large scale organizationally sponsored intervention programs. Needless to say, not all of the attempts to change smoking behavior have been successful. The lack of success in smoking

cessation attempts is due to a number of factors. One of the points which has become increasingly more apparent from the study of smoking behavior and cessation attempts is that cigarette smoking is associated with a variety of events and habits. In many cases discontinuing smoking or attempting to discontinue smoking either breaks those associations or threatens to break them. The important points to be made are: (1) that people smoke for a variety of reasons under a variety of different circumstances; (2) it could be expected that a wide variety of types of smokers could be identified, and (3) according to Hochbaum "This implies that the problem of causation may also differ between these types of smokers, and that, therefore, approaches, methods, and techniques to facilitate discontinuation will have to differ in some ways" (1965: 694).

The point that Hochbaum refers to is that because there are smokers who smoke for different reasons, have different social situations, and may be different in a social psychological sense, the notion of type of smokers or categories of smokers is valid. The assumption that is made is that by somehow establishing or identifying the types or categories of smokers one can develop intervention programs focusing on people in a category. The utility of the categorization has been pointed out by Hochbaum and is illustrated in his statement that "we could then group these smokers according to

common characteristics, and we could use with each group those approaches, methods, and techniques which appear most promising in the light of its prevalent characteristics" (1965: 695). It has been indicated previously that multiple discriminant function analysis can be used to test the categories that might be postulated. Thus, it is a method for grouping smokers. The identification of the characteristics and specification of the categories is problematic to the fulfillment of the "establishment of types or categories of smokers" as envisioned by Hochbaum.

Dependent Variables

One categorization or set of dependent variables, and probably the one most obvious, includes the following four categories: nonsmoker, former smoker, current smoker who has attempted to stop smoking and current smoker who has made no attempt to stop. These categories are defined as follows: (A) nonsmoker -- an adult who has smoked 100 or fewer cigarettes in his lifetime; (B) former smoker -- an adult who no longer smokes cigarettes; (C) current smoker who has attempted to stop smoking -- an adult who has made at least one attempt to stop smoking but was smoking cigarettes prior to the time of the interview; and (D) current smoker who has made no attempt to stop -- an adult who had not made an attempt to stop smoking cigarettes. For the sake of brevity,

the categories will be identified as nonsmoker (NSMKR), successful (SUCCES), unsuccessful (UNSUCS) and no attempt (ATTNOT), respectively. Horn is one of many suggesting the need to explore the categorizations based on smoking behavior. His reference to the categorization problem can be found in his statement that "sometimes the 'never smoked' and the 'former smoker' are quite similar and quite different from 'current smoker,' sometimes 'former smoker' and 'current smoker' are quite similar and quite different from 'never smoked'" (1966: 50).

The adoption stages can be applied to the four categories of smokers. It should be noted that the decremental innovation of smoking cessation does not apply to the nonsmokers. For all intents and purposes they don't have to stop smoking cigarettes for they never really started. The people in the "successful" category have adopted the innovation and are no longer smoking cigarettes. The "successful" category is, thus, in the adoption stage. The "unsuccessful" and the "no attempt" categories represent the people to whom intervention programs will be directed. The "unsuccessful" have been through the trial stage and for some reason have not proceeded to the action adoption stage. The people in the "no attempt" category have not gotten to the final stage and have apparently not gone beyond the evaluation stage, if they have gone that far.

The four categories represent the basic units for the dependent variables used in the analyses which follow. Four sets of analyses will be done using the "smoker categories." The first analysis will use all four of the categories to represent the values of the dependent variable. This analysis will provide a test of the statement made by Horn that indicates that one should explore the differences and similarities among and between all four of the categories. A second analysis will concentrate only on those categories that represent the "smokers" both current or former. The elimination of the nonsmokers from the analysis will permit the test of the difference or similarity that exists among those who have or still do smoke cigarettes. The third and fourth analyses are concerned only with the current smokers. One of the analyses will use the "unsuccessful" and "no attempt" categories to represent the values of the dependent variable.

The fourth analysis is based on a further split of the "unsuccessful" and "no attempt" categories on the basis of sex. This categorization is based on the findings of Winkelpleck (1971) that indicate that the development of attitude scales, using data from the same study that this dissertation is using, was affected by sub-categories and sex was found to be one of the variables that affected the items that would be included in a scale with a reliability coefficient sufficient to make the scale statistically acceptable.

The case for using sex as a variable for studying the cessation process is pointed out by Zagona in his reference to the work by Dr. Joan S. Guilford. Zagona indicates that Dr. Guilford "believes more intensive comparative studies need to be made and the future treatment should consider the possibility of differential approaches to male and female studies based on the results of these studies" (1968: 92). Therefore, the categories of "male unsuccessful," "female unsuccessful," "male no attempt," and "female no attempt" provide the categories for the fourth level of analysis using the "smoker categories."

In summary, then, the categories to be used in the analyses are as follows:

(1) All Categories

(a) Nonsmoker, (b) Successful, (c) Unsuccessful, and (d) No attempt

(2) Smokers

(a) Successful, (b) Unsuccessful, and (c) No attempt

(3) Current smokers

(a) Unsuccessful and no attempt

(4) Current smokers by sex

(a) Male unsuccessful, (b) Female unsuccessful, (c) Male no attempt, (d) Female no attempt

Before proceeding, it should be noted in this dissertation the focus is primarily on the use of multiple discriminant

function analysis in an exploratory situation which involves the separation of one population into subpopulations and the determination of the existence of more than one "audience" or target group. Therefore, alternative sets of dependent variables and independent variables will be used in the analyses so that the position that smoking behavior is multi-dimensional rather than unidimensional can be explored. The dimensionality in this case refers to the existence of types or categories as indicated by Hochbaum (1965: 695).

Independent Variables

With the identification of the dependent variables completed, the next step involves the identification of the independent variables. These are the variables, which when combined in the multivariate analyses, will be used to test the multidimensionality of the categories and provide insights into the audience - audience's dilemma.

Implicit in the approach used to select variables in this dissertation is the assumption that there are a number of possible intervention techniques which might be based on the variables identified. The point that should be made explicit at this time is that the discussion and analyses which follow focus on the problem of identification of variables which relate to categories of smokers and the results of the analyses

may provide insights for anyone or combination of possible intervention techniques. No attempt is being made to predict a combination of independent variables which might be best for a specific intervention technique. In fact, the stepwise analysis is most appropriately used in an exploratory situation.

The previously discussed set of criteria is concerned with the selection of the variables. Each of the variables selected is represented by data from the same study. These data provide the "empirical" basis for categorization that was referred to in the preceding chapter. Since the analyses focus on the problem of changing smoking behavior, consideration is given to the selection of variables which have been used by others in studying this problem and which might provide insights into cessation and the development of intervention efforts. These considerations give rise to the need for an orientation or frame of reference to be used in order to give the variables an integrated theoretical meaning.

The scope of the problem of developing an intervention program or intervention programs directed toward achieving the goal of getting smokers to stop smoking appears at times to be almost overwhelming. Numerous attempts have been made to bring a solution to the intervention problem. Because the basic role that they play in understanding behavior, communications and decision making, or more specifically, diffusion

and adoption have been suggested earlier to serve as a basis for the conceptual orientation for selecting the dependent variables and thus dealing with the audience delineation problem.

The relationship between intervention and adoption and diffusion is based on the assumption that in order to change behavior, some kind of message regarding the change and a decision made regarding the message are integral parts of an intervention process. The determination of the appropriate combination of the characteristics of the sender, the message, the channel, and the receiver is problematic to effect the desired behavior change. Of major concern at this point is the identification of those variables which represent the receiver. More specifically, the concern is with the identification of variables which will be used to separate groups of receivers or what have been described previously as audiences. The "adoption" of the message is seen as a goal in the intervention process but the identification of the potential receivers is problematic to obtaining the goal of adoption and the resulting behavioral change.

Theoretical orientation

Previous reference was made to Bohlen's statement that there is a need to determine "what characteristics or combination of characteristics are associated with the differential

in the acceptance of cultural innovations" (1964: 267). The mass communication literature have provided some direction in identifying variables or at least identifying frames of reference which are aimed at bringing order to the large list of variables that identify the "receiver" of the messages. DeFleur has summarized the "frames of reference" (1971: 118). Two of the frames of reference are particularly relevant at this point. The frames of reference are identified as the "Individual Differences Theory" and the "Social Categories Theory" and are said to generally represent the thinking of psychology and sociology respectively. The point of interest for this dissertation is not so much using the "theories" to understand the effects of mass communications but to use them to identify the different variables which might be used to describe audiences or potential audiences. It is thought that the variables that are used to focus on the researching of the effects of mass communication can also be used to "describe" those affected.

When the two "theories" are assessed to determine how they might be used to describe those who receive mass communication messages, two kinds of variables can be used to summarize the two theories. The first kind of variables, and the ones that represent the Individual Differences Theories, can be called the social psychological variables. The social psychological kind of variables represent such

variables as attitudes and perceptions. The variables that are represented by the "Social Categories Theories" can be identified as socio-demographic or as demographic variables. The kinds of variables represented would include age, residence, education, economic status, etc.

These two kinds of variables have been selected for use in the analyses for they represent, or at least are thought to represent, two important considerations. The social psychological variables are included because DeFleur has been postulated that human beings varied greatly in their personal psychological organization" (1971: 121) and that the demographic variables "influence the individual's degree and direction of exposure to the mass communicated campaign material on the one hand, and the kinds of effects that such material would have upon him, on the other hand" (1971: 126).

The effects of a mass communication campaign have been explained with a third theory, namely, the Social Relationships Theory. The variables identified by this theory generally relate to "social groupings." The variables identified in this theory represent the individual's social milieu or his social situation or his environment. There is apparently a potential for audience delineation that lies in the environmental variables. DeFleur indicates that the "...recognition that informal social relations play a significant role in modifying the manner in which an individual will act upon a message

which comes to his attention..." (1971: 127), becomes an important point in adding to the range of variables that might be used to discriminate between audiences. In the case of smoking behavior, the environmental variables would include such factors as the extent to which the individual's social situation facilitates or inhibits the discontinuation of cigarette smoking. Also included in the social situation are the social relationships that an individual experiences and these relationships that are part of the environmental variables.

There are a number of variables that might be used in an analysis determining the verity of the proposition that the smoking population is heterogenous. One of the problems that is faced in such analyses is the reduction of the number of variables to a meaningful and manageable set. When one considers the research that has been done in the area of smoking behavior a pattern of variable use and categorization can be identified. Generally speaking, the variables can be classified into one of four categories: demographic, social psychological, environmental and behavioral. These categories coincide with those suggested by DeFleur. A more specific discussion of the importance of these four types of variables follows.

The description of smoking behavior is useful from at least two standpoints. First, a description of the extent

of cigarette smoking is needed in order to identify the extent to which a problem exists and as a partial basis to decide whether an intervention program is needed. Further, identification of those who have never smoked, those who have stopped smoking, those who have attempted to stop smoking but failed, and those who have never attempted to stop smoking: 1) will further quantify the total sample and 2) should, with related data, provide valuable insights into the "success" or "failure" elements in cessation which could be of value in formulating intervention strategies. A description of 1) the extent of cigarette smoking, 2) the behavior patterns regarding continuing and/or discontinuing smoking, and 3) some of the behavior patterns identified with attempted discontinuation can provide a basis for intervention programs.

There are many variables that can be identified as being related to behavior. Some of the behavior related variables are discussed below.

Several main conditions that influence man's behavior can be outlined. Among these are an organized accretion of past experience, perceptions of desirable outcomes, and evaluation of acceptable goals and means. These represent some of the personal attributes of man. Two subconcepts of personal attributes that have been identified are the demographic and the social psychological.

Certain attributes of the individual have been identified

as personal characteristics. The attributes that will be presented as personal characteristics might also be called socio-demographic variables. Age, years of formal education, marital status, occupation, and income are included as personal characteristics. These variables serve two main purposes. First, they provide a basis for describing and identifying individuals and make it possible to analyze the range and distribution of these characteristics in a sample. Second, based on logical inference and past research, knowledge of these characteristics may provide a partial basis for understanding and possibly predicting certain types of behavior. For example, Horn has found that "Those who considered quitting (smoking cigarettes) had more formal education, higher income, were younger, and more likely to be married than those who did not" (1968). Thus, personal characteristics provide a means for identification and description which, hopefully, can aid in understanding and modifying behavior.

Beliefs and attitudes are two types of social psychological variables. Beliefs may be defined as an individual's perception of the relationships that exist or have existed between phenomena. Belief is differentiated from value, which is a subjective interpretation of relationships which ought to exist between phenomena (e.g., "value judgments" indicating "good or bad, right or wrong"). Belief is also differentiated from attitude, which is defined as the degree

of positive or negative affect toward a psychological object and represents the individual's tendencies to act based on values. Beliefs and attitudes are presented as separate variables and each is assumed to have an effect on behavior.

An individual forms (or derives) his beliefs from many different sources. Society sets up institutionalized structures through which man learns; e.g., the family, the church and the educational system. An individual is exposed to many channels of communication which may influence his beliefs. Many types of mass media are available; e.g., newspapers, radio, television. An individual can obtain more detailed and specific information from books, bulletins, pamphlets, and brochures. He may also derive his beliefs from personal contacts with other individuals. The interpretation of his own and other people's experiences can also serve as a basis for the formulation of beliefs.

Beliefs have been defined as an individual's perception of the relationships which exist between phenomena. That is, beliefs are one of the ways that man brings order to the world around him. It has been indicated that man is an organizing being. He takes the data he has and organizes them in a manner meaningful to him. Different individuals may construct very different worlds of reality. Since beliefs serve as an indicator of an individual's constructed world of reality, it is useful to find out what beliefs an

individual holds.

An action consists of three stages: 1) receiving a stimulus, 2) interpreting that stimulus within the situation in which it is received, and 3) responding to the stimulus in order to fulfill a goal. The stimulus-interpretation-response patterns of the past serve as the experience world for present and future actions. As an individual has experiences, he makes judgments about those experiences. These judgments about past experiences form an individual's value system. Values have been defined as a subjective interpretation of relationships which the individual thinks ought to exist between phenomena.

The individual's value system provides the basis for his tendencies to act in relation to the stimuli he receives. These tendencies to act are commonly referred to as attitudes and can be described as a state of readiness to deal with an object or situation; they predispose the individual to act in a given way under a specified set of circumstances. Attitudes are thought to have an effect on determining what stimuli or messages are received, the interpretation of stimuli, the choice of goals, and the choice of acceptable means to achieve those goals.

Attitudes also have dimensions that may help in understanding human behavior. Generally, the dimensions of attitudes can be identified as: 1) direction--for or against,

positive or negative, agree or disagree; 2) degree--the variation in direction--for example, very favorable or just favorable; 3) intensity--the degree of conviction with which an attitude is held; and 4) salience--the importance of a given attitude within the constellation of attitudes. This study is primarily concerned with direction and degree of attitudes toward smoking and health.

From an educational point of view, it is important to recognize that new experiences, including the receiving of information, may change existing attitudes. Providing stimuli to reinterpret past experiences may also lead to changes in attitudes. Before an attempt is made to modify attitudes, the attitudes held at specific points in time should be known. Without this information an attempt at attitude modification might prove to be unnecessary or be focused on the wrong attitudes.

The analysis of attitudes and beliefs measured in this study should indicate which attitudes and beliefs are held in common by most of the respondents and those upon which there is disagreement. The analysis should also indicate the commonality or differences in attitudes held by the people in the different smoking behavior based categories. The data can be used to indicate which attitudes and beliefs need reinforcement and those toward which intervention programs might be directed if there is a desire to change or

modify the existing attitudes and beliefs. The insights gained from this study pertaining to attitudes and beliefs should aid in choosing the content, appeals and methods for conducting effective intervention programs.

Man's actions or behaviors are not only based on or a result of his personal attributes--social psychological and demographic characteristics. He also considers the context or situation in which a stimulus is received and within which he must act. Therefore, the situation or social environment of the individual becomes relevant in understanding and predicting behavior. One element of man as a social being is that he acts in relation to others. The others may be those involved by an intimate or personal relationship with the actor, or more indirectly or psychologically associated with the actor. The others with whom the individual relates either directly or indirectly, or personally or impersonally, are components of the situational factors that affect his behavior.

For heuristic purposes the concept of situational factors can be separated into two subconcepts. The first subconcept consists of situational factors most closely identified with the individual--these are designated as personal situational factors. The second subconcept consists of those situational factors which are assumed to have potential for affecting the individual but which are less intimate to him--these are

designated as community situational factors. It is thought that the separation of situational factors into personal and community factors facilitates the identification and description of the social milieu within which the individual receives stimuli and within which he must act in response to those stimuli.

Further justification for categorizing variables according to the four categories listed above can be found in the research reported by Horn and by Schwartz and Dubitzky. The following discussion concerns a brief description of the variables as proposed by these researchers.

The position taken by Horn (1970a: 89) is that "the cessation of smoking depends on cultural, psychological, and social factors." He continues by indicating "four elements enter into these behaviors." The elements identified by Horn are:

(1) The reasons for giving up smoking - or not giving it up. Cultural factors play an important role here here,

(2) The perception of health threat,

(3) The psychological use to which smoking is put,

(4) Social factors which facilitate or inhibit either continuing smoking or continued success as a non-smoker (1970a: 90).

The data from the Smoking Control Research Project reported by Schwartz and Dubitzky "has uncovered a number of demographic, background, psychosocial and environmental variables as well as factors related to the smoking habit itself which are predictive of long-term success in smoking withdrawal" (1969: 137).

They found that variables like "number of cigarettes smoked per day" and "community support" contributed to the identification of potentially successful quitters. By combining the insights on the types of variables from Schwartz and Dubitzky and from Horn with the insights on the intervention process gained from Horn and the adoption model, a set of variables for use in the analysis was selected. The variables which were included in the set for analytical purposes are listed on Table 1.

The adoption stages represent a point in time and are, in a sense, historically descriptive. Also, the stages themselves represent dependent variables and as such can be manipulated only through the manipulation of certain independent variables. In addition to the dependent variables which represent points in the adoption process, two variables have been included as independent variables that represent the adoption process. One variable is a measure of awareness (X8) and the other is a measure of the evaluation process (X9).

As stated earlier, the purpose of the use of the adoption

model in this dissertation is to serve as a frame of reference and it is not the purpose of the study to test the model per se.

The analysis focuses on identifying a set of independent variables which may be used in intervention programs for "screening" so as to facilitate the implementation of cessation techniques. After researching the kinds of variables used in research related to the cessation of cigarette smoking that has been reported by Borgatta and Evans (1968), Graham and Gibson (1967), Hochbaum (1965), Horn (1970a), Mausner and Platt (1966), Schwartz (1970), Schwartz and Dubitzky (1969), Straits (1967), Tomkins (1966), U.S. Public Health Service Report (1964), and the data that were available from the Iowa State Smoking Behavior Study, the variables listed on Table 1 were selected. Other variables might have been included as independent variables, but were omitted for one or more of the following reasons:

(1) Data missing for a large number of respondents. For example, Average Gross Family Income was not included, for 33 respondents did not provide the income information.

(2) There was not sufficient variance to merit inclusion in the analysis. For example, 90% of the respondents indicated that they were aware of the statement. "Caution" Cigarette smoking may be dangerous to your

Table 1. Independent variables used in analyses

	Independent Variables	Categories for Analysis: All Categories	Smokers	Current & Current by Sex	Types of Variable: Demographic	Social Psychological	Environmental	Behavioral
X1	Education	X	X	X	X			
X2	Age	X	X	X	X			
X3	No. of people in household	X	X	X	X			
X4	Insurance	X	X	X	X			
X5	Perceived Concern	X	X	X		X		
X6	Major health problems	X	X	X		X		
X7	Cause of health problems	X	X	X		X		
X8	Aware smokers should stop	X	X	X		X		
X9	Think smokers should stop	X	X	X		X		
X10	Change of acceptance in community	X	X	X			X	
X11	Situation facilitates smoking	X	X	X			X	
X12	Change of acceptance in general	X	X	X			X	
X13	Sampling strata	X	X	X	X			
X14	Alternative like to use	-[a]	-[a]	X		X		

[a]Variables represent questions which were not asked of the Nonsmoker or Successful groups and were therefore not used in the analysis of categorization using either of these two groups.

Table 1 (Continued)

Independent Variables	Categories for Analysis			Types of Variable			
	All Categories	Smokers	Current & Current by Sex	Demographic	Social Psychological	Environmental	Behavioral
X15 Decision at present	-[a]	-[a]	X				X
X16 Status of head of household	X	X	X	X			
X17 Total number organizations and member of	X	X	X			X	
X18 Attitude-restriction on sales and advertising	X	X	X		X		
X19 Attitude, smoking and health	X	X	X		X		
X20 Attitude, behavior and exemplars	X	X	X		X		
X21 Attitude, information on smoking and health	X	X	X		X		
X22 Beliefs	X	X	X		X		
X23 Situation	-[a]	-[a]	X			X	
X24 Number smoked at heaviest	-[a]	-[a]	X				X
X25 Number smoked at present	-[a]	-[a]	X				X

health" that appears on cigarette packages. Other variables also had 80% to 90% of the responses in one response category.

(3) Data were not available from the Iowa State Smoking Behavior Study. For example "dosage scores" were not determined in the study.

The discriminatory power of each variable is one of the criteria used in selecting the variables for consideration in the audience - audiences problem. Point two (2) above indicated that some variables were eliminated because of the small amount of variance in the responses. To a point, the amount of variance in a variable represents its discriminatory power. If there is no variance or relatively little variance the variable will not add much, if any, to a discriminant analysis. If the "no variance" situation is not the case the variable may add to the discriminant analysis. It should be remembered that the stepwise analysis will serve to select those variables that maximize the discrimination among the categories. Therefore, it is possible that not all of the variables listed on Table 1 will be included in the tests of the hypotheses since not all variables provide a discrimination among the groups.

Kinds of variables

Methodologically there are three kinds of variables that are used in the analyses. First there are those variables that are measured more or less directly. This is accomplished by asking one question and assigning a value to the response to that question. For example, age (X_2) was measured by using the question "What is your date of birth?" The date of birth was recorded and this was converted to years. Thus, age was attained by one question.

A second kind of variable is one that is the result of aggregating the responses to a number of questions. According to Kerlinger an index is "a number that is a composite of two or more numbers" (1965: 616). It is indicated by Warren et al. (1969: 19) that is the reliability of the composite is calculated and if that reliability exceeds minimum acceptable to the researcher, the result is a scale with known properties. An example of an index that is not a scale is the variable insurance (X_4). This variable was developed by combining the responses to the questions, "Do you have any type of life insurance?" and "Do you have any type of health (other than accident) insurance?" The result of the aggregation of the responses to these two questions was a composite score indicating the areas covered by insurance. That is, the respondent could have been assigned values according to the following criteria:

1 = has neither life nor health insurance

2 = has either life or health insurance

3 = has both life and health insurance.

The following variables also represent composite scores: Perceived Concern (X_5), Major Health Problems (X_6), and Situation Facilitates Smoking (X_{11}). The procedures for developing these composite scores are presented in Appendix B.

One of the most common areas for the use of various procedures for developing scales is the area of attitudes and beliefs. The procedures for developing scales can involve either theoretical criteria empirical criteria or both. If only the theoretical criteria are used the result is composite scores or indices as described above. If the empirical criteria are used either alone or combined with the theoretical criteria the result is an index that is the scale for the dimension that the items are measuring.

The procedure used to develop the scales used in this dissertation combined the theoretical and the empirical criteria. Items were grouped according to the dimensions of the attitude, beliefs or situation that they were measuring. Each dimension was considered a scale on the basis of content validity. According to Kerlinger "content validity is guided by the question: Is the substance or content of this measure representative of the content or the universe of content of the property being measured" (1965: 446).

After having grouped the items by their respective dimension the scales were tested empirically for scalability using the coefficient of reliability (r_{tt}) as defined by Richardson (1936: 70). Warren et al., point out that researchers have indicated that additivity is "one of the most important properties of a scale in social sciences"(1969: 13). They further point out that as a first condition "the relationships among the responses to different stimuli (items) must be linear". The procedure for determining the condition of additivity of the scales used herein follows the outline suggested by Warren, et al. (1969: 14). The procedure is presented below.

After having grouped the items according to the dimensions they are thought to represent a correlation matrix including item total correlation coefficients is calculated. A comparison is made between the minimum acceptable item total correlation coefficient (r_{it}) and the calculated r_{it}'s of each scale based on the data from the study. The minimum acceptable r_{it} is obtained by the formula: $r_{it} = 1/\sqrt{n_j}$ where: n is the number of items in the dimension being considered.

The next step is the calculation of the average intercorrelation coefficient ($\bar{r}_{ij}$) which is used in the calculation of the coefficient of reliability.

$$\bar{r}_{ij} = \Sigma r_i/n \qquad \text{(Formula 1:3)}$$

where:

ri = the summation of the interitem correlation coefficients associated with those variables for which r_{it} exceeds $1/\sqrt{n_j}$.

n = the number of inter item correlation coefficients summed.

Finally, the coefficient of reliability is calculated using the formula

$$r_{tt} = \frac{n(\bar{r})}{1+(n-1)\bar{r}} \qquad \text{(Formula 1:4)}$$

where

n = the number of items

$\bar{r}$ = the average intercorrelation among the items

Using the procedure outlined above the coefficients of reliability were calculated for the variables that are scales. The information on the reliability of the scales is presented in Table 2.

The scales used in this dissertation have been developed using the coefficient of reliability as defined as Richardson (1936) and although the scales have not been tested for all of the conditions that they might have been, the condition of linearity has been met. On the basis of the tests for

Table 2. Reliability data on scales

	Scale Name	Coefficient of reliability (r_{tt})	Magnitude of average interitem correlation coefficient	Number of items in scale
X_{18}	Attitude-restriction on sales and advertising	.6806	.2334	7
X_{19}	Attitude-smoking and health	.8091	.1954	11
X_{20}	Attitude-behavior of exemplars	.8959	.6828	4
X_{21}	Attitude-information on smoking and health	.5659	.2458	4
X_{22}	Beliefs	.7090	.2130	9
X_{23}	Situation	.7247	.3050	6

linearity the summation of the responses to the items in the scales have been treated as scores and the scores represent the operational definitions of the respective attitude, belief and situation variables (see Appendix C).

Appendix B provides the measures for all of the variables used in the analyses and the frequency distributions of the values of the variables.

Hypotheses

The need for some way of categorizing smokers in order to facilitate the development of intervention programs has been expressed by a number of researchers and change agents. The position that the people take who express the need to explore the existence of subgroupings within the smoking population is based on the general proposition that the audience toward whom smoking intervention programs might be directed is heterogeneous.

The findings of the tests of this general proposition are presented in the Findings and Conclusions chapter. Before getting to the findings the explication of the general proposition follows. Using the generally accepted form for hypothesis testing the null hypotheses will be presented for testing. Blalock points out that "the hypothesis which is actually tested is often referred to as a 'null hypothesis' (symbolized as H_0) as contrasted with the 'research hypothesis' (H_1) which is set up as an alternative to H_0. Usually, although not always, the null hypothesis states that there is no difference between several groups or no relationship between variables whereas the research hypothesis may predict either a positive or negative relationship. The researcher may actually expect that the null hypothesis is faulty and should be rejected in favor of the alternative H_1. Nevertheless, in order to compute a sampling distribution he must

for the time being proceed as though H_0 is actually correct" (1960: 121). Following this convention the proposition that "the audience toward whom smoking interventions might be directed is heterogeneous" will be used to provide the basis for the research hypothesis. The null hypothesis will state that the population is homogeneous or that subpopulations of smokers do not exist. More specifically, the null and research hypotheses are listed below.

General Null Hypothesis:

H_0 - The audience toward whom smoking intervention programs might be directed is homogeneous.

General Research Hypothesis:

H_1 - The audience toward whom smoking intervention programs might be directed is not homogeneous.

When the smoker categories and the use of multiple variable analysis are applied to the general hypothesis there are three Sub General Null Hypotheses and their respective research hypotheses that can be formulated.

Sub General Hypotheses:

All Categories:

Sub Gen H_{0_A} - When a number of variables are considered simultaneously there is no differences between Nonsmoker, Successful, Unsuccessful and No Attempt categories

Sub Gen H_{1_A} - When a number of variables are considered simultaneously there is a difference between Nonsmoker, Successful, Unsuccessful and No Attempt categories.

Smoker Categories:

Sub Gen H_{0_B} - When a number of variables are considered simultaneously there is no differences between Successful, Unsuccessful and No Attempt categories.

Sub Gen H_{1_B} - When a number of variables are considered simultaneously there is a difference between Successful, Unsuccessful and No Attempt categories.

Current Smokers Categories:

Sub Gen H_{0_C} - When a number of variables are considered simultaneously there is no difference between Unsuccessful and No Attempt categories.

Attempt Categories:

Sub Gen H_{1_C} - When a number of variables are considered simultaneously there is a difference between Unsuccessful and No Attempt categories.

When the point that sex is thought to be an important factor in smoking cessation is taken into consideration a fourth Sub General Null Hypothesis can be formulated.

Current Smokers by Sex Categories:

Sub Gen H_{0_D} - When a number of variables are considered simultaneously there is no difference between Male Unsuccessful, Female Unsuccessful, Male No Attempt and Female No Attempt categories.

Sub Gen $H_{1_{D_1}}$ - When a number of variables are considered simultaneously there is a difference between Male Unsuccessful, Female Unsuccessful, Male No Attempt and Female No Attempt categories.

The hypotheses can be explicated the next step to where there is a reference to one of the statistics that represents the empirical means of determining whether or not differences do exist. In the case of discriminant function analysis that

statistic is concerned with the group means (μ).[1]

Thus, the Empirical Null Hypotheses (EH_0) and the respective Empirical Research Hypotheses (EH_1) for this dissertation are listed below.

Empirical Null Hypotheses:

All Categories:

$$EH_{0_{A_1}} : \mu_1 = \mu_2 = \mu_3 = \mu_4$$

$$EH_{1_{A_1}} : \mu_1 \neq \mu_2 \neq \mu_3 \neq \mu_4$$

This hypothesis is an overall hypothesis of equality of group means. It is also possible to test hypotheses involving group means for pairs of groups if the null hypothesis regarding the overall equality of group means is found not to be supported.

All categories hypothesis are as follows:

$$EH_{0_{A_2}} : \mu_1 = \mu_2$$

$$EH_{1_{A_2}} : \mu_1 \neq \mu_2$$

---

[1]Where μ represents the population group means. That is, μ_1 represents the group means of the population represented by the group Nonsmokers, μ_2 the group means of the population represented by Successful, etc.

$EH_{0_{A_3}}: \mu_2 = \mu_3$

$EH_{1_{A_3}}: \mu_2 \neq \mu_3$

$EH_{0_{A_4}}: \mu_3 = \mu_4$

$EH_{1_{A_4}}: \mu_3 \neq \mu_4$

$EH_{0_{A_5}}: \mu_1 = \mu_3$

$EH_{1_{A_5}}: \mu_1 \neq \mu_3$

$EH_{0_{A_6}}: \mu_1 = \mu_4$

$EH_{1_{A_6}}: \mu_1 \neq \mu_4$

$EH_{0_{A_7}}: \mu_2 = \mu_4$

$H0_{1_{A_7}}: \mu_2 \neq \mu_4$

Smoker Categories:

The set of empirical hypothesis for testing the overall equality of means for the groups is as follows:

$EH_{0_{B_1}}: \mu_2 = \mu_3 = \mu_4$

$EH_{1_{B_1}}: \mu_2 \neq \mu_3 \neq \mu_4$

The empirical hypotheses for testing the equality of means between pairs of groups are as follows:

$EH_{0_{B_2}}: \mu_2 = \mu_3$

$EH_{1_{B_2}}: \mu_2 \neq \mu_3$

$EH_{0_{B_3}}: \mu_3 = \mu_4$

$EH_{1_{B_3}}: \mu_3 \neq \mu_4$

$EH_{0_{B_4}}: \mu_2 = \mu_4$

$EH_{0_{B_4}}: \mu_2 \neq \mu_4$

Current Smoker Categories:

Since there are only two groups - Unsuccessful and No Attempt in this categorization there is only one set of empirical hypotheses. That set of hypotheses is as follows:

$EH_{0_{C_1}}: \mu_3 = \mu_4$

$EH_{1_{C_1}}: \mu_3 \neq \mu_4$

Current Smoker Categories by Sex:

The set of empirical hypotheses for testing the overall equality of means for the groups is as follows:

$$EH_{0_{D_1}} : \mu_{13} = \mu_{23} = \mu_{14} = \mu_{24}$$

$$EH_{1_{D_1}} : \mu_{13} \neq \mu_{23} \neq \mu_{14} \neq \mu_{24}$$

The empirical hypotheses for testing the equality of means between pairs of groups as follows:

$$EH_{0_{D_2}} : \mu_{13} = \mu_{23}$$

$$EH_{1_{D_2}} : \mu_{13} \neq \mu_{23}$$

$$EH_{0_{D_3}} : \mu_{23} = \mu_{14}$$

$$EH_{1_{D_3}} : \mu_{23} \neq \mu_{14}$$

$$EH_{0_{D_4}} : \mu_{14} = \mu_{24}$$

$$EH_{1_{D_4}} : \mu_{14} \neq \mu_{24}$$

$$EH_{0_{D_5}} : \mu_{13} = \mu_{14}$$

$$EH_{1_{D_5}} : \mu_{13} \neq \mu_{14}$$

$$EH_{0_{D_6}} : \mu_{13} = \mu_{24}$$

$$EH_{1_{D_6}} : \mu_{13} \neq \mu_{24}$$

$$EH_{0_{D_7}} : \mu_{23} = \mu_{24}$$

$$EH_{1_{D_7}} : \mu_{23} \neq \mu_{24}$$

The final step in the explication of the hypotheses involves the testing of the empirical hypotheses with the appropriate statistical tests. There are two statistics which will be used to test the hypotheses. These two statistics and the findings which result from their application to the data will be presented in the Finding and Conclusions chapter.

F Statistics

As has been indicated above one of the empirical hypotheses for each of the categorizations is concerned with the overall equality of means for the groups. If there are more than two groups in the categorization the other empirical hypotheses are concerned with the equality of means between pairs of groups.

The "Approximate F Statistic" provides the test statistic to test the hypotheses of overall equality of group means. The second test statistic is concerned with the equality of means between groups. The calculated value of this statistic is provided in an F matrix. The sampling distribution for both of these statistics is F.

Before discussing more fully the F tests using the Approximate F statistic and the F statistics from the F Matrix it should be pointed out that there are two statistical

criteria that must be met before the tests of the hypotheses is appropriate. Those criteria are: (1) meeting the minimum F to enter for each variable in the Stepwise analysis and (2) completing "g" steps in the stepwise analysis. These criteria represent a series of tests that must be passed sequentially. The failure to meet the minimum F to enter obviates the progression to the next test which is the completion of "g" steps and the failure to complete "g" steps obviates the progression to the Approximate F test and the failure of the Approximate F test to be statistically significant obviates the application of the F values from the f matrix to test the equality of group means between pairs of groups.

It is necessary for at least one of the variables in the stepwise analysis of any given categorization to have an F value that exceeds the F to enter criterion in order that the analysis might begin. The degrees of freedom for F to enter at any given step is equal to g-1 and n-g-r.

Where:

g = number of groups

n = total number of cases

r = step number

The stepwise analyses for all of the hypotheses entered at least one variable but one of the categorizations did not meet the g steps criterion. This criterion requires that

it is necessary for the number of variables to be at least equals to the number of groups ($p \geq g$) (Dixon, 1971).

Where:

p = number of variables

g = number of groups

The Current Smoker categorization entered only one of the variables in the stepwise analysis. Because the analysis for this categorization was terminated with an insufficient F to enter before reaching the $p \geq g$ criterion the use of the approximate F is not appropriate. The other three categorizations - All Categories, Smokers, and Current Smokers by Sex - met the $p \geq g$ criterion and were tested with the Approximate F.

It has been pointed out that the empirical null hypotheses for the test of equality of means follow the form: $\mu_1 = \mu_2 = \mu_3$. The Approximate F is used as the statistic to test the equality of the group means for the variables that were entered in the stepwise analysis and is defined as follows:

$$F = \frac{1-U^{1/S}}{U^{1/S}} \cdot \frac{ms + 1 - rq/2}{rq} \qquad \text{(Formula 1:5)}$$

The degrees of freedom for the Approximate F are: rq and ms+2 - rq/2 where:

r = step number

q = g-1 (groups minus 1)

$m = n = \frac{r+q+3}{2}$

$$s = \sqrt{\frac{r^2q^2-4}{r^2+q^2-5}}, \text{ if } r^2 + q^2 \neq 5$$

$s = 1$, if $r^2+q^2 = 5$

The Approximate F provides an overall test of equality of group means. The null statistical hypotheses tested by the Approximate F follow the form:

$$\text{Tabular } F_{.05/d.f.} > \text{Approximate } F .$$

The conclusion from the support of this hypothesis would indicate that the inequality of group means is no greater than expected by chance at the .05 level of significance. The conclusion from the test that fails to support the null hypothesis would indicate that the inequality of group means is greater than expected by chance. Therefore, the research hypothesis could be accepted. This would indicate that the variables entered in the stepwise analysis do discriminate among the groups and consideration should be given to treating the population in terms of categories or as different populations rather than treating it as a singular or homogeneous population. Following the conventional interpretation of an overall F test if the Approximate F exceeds the

tabular F value, it can be concluded that the group means are not all estimates of a common population mean.

Having found an overall F to be significant the differences of means between pairs of groups can be tested. This is accomplished using the F matrix. If three groups have been postulated the form of the empirical null hypotheses would be:

$\mu_1 = \mu_2$, $\mu_2 = \mu_3$, $\mu_1 = \mu_3$

Where:

μ_1 = group 1 means

μ_2 = group 2 means

μ_3 = group 3 means

The F matrix takes the form:

	G_1	G_2
G_2	$F_{(12)}$	
G_3	$F_{(13)}$	$F_{(23)}$

Where each cell contains a calculated F value and that value is used to test the equality of group means between the two groups. For example F_{12} provides the F value to test the hypothesis $\mu_1 = \mu_2$. The degrees of freedom for the F matrix are defined as: d.f. = r and n - r + 1

where:

r = step number

n = total number of cases

If the F value for a test of equality of group means is significant, it may be concluded that the group means are not estimated of a common population mean. The statistical null hypotheses for the test of equality between group means follows the form:

$$\text{Tabular } F_{.05 \text{ d.f.}} > \text{Calculated F}$$

With the description of the statistical tests having been provided the next step is to apply the tests to the data that pertain to the respective hypotheses. The tests of the hypotheses are presented in Chapter V. But, before proceeding to a test of the hypotheses a brief description of the procedures for collecting the data used in the tests will be presented.

CHAPTER IV. EMPIRICAL STUDY

Introduction

Even though this dissertation has a heavy methodological thrust, it deals with a present day concern of society. Therefore, it is appropriate to present a discussion of the empirical arena that has served as the focal point of the study and that provides the data for the analyses. This section will discuss the smoking behavior research design, which includes the sampling, data collection procedures and measurement of the variables.

The data being utilized in this dissertation were collected by the Department of Sociology and Anthropology at Iowa State University, Ames, Iowa, under contract No. PH86-68-129 with the National Clearinghouse for Smoking and Health, Public Health Service. The project was under the direction of Dr. George M. Beal, Dr. Gerald E. Klonglan, and Richard D. Warren. The general objective of the entire research project was to gather data related to the potential for intervention in and description of nonmetropolitan areas regarding cigarette smoking.

Data were collected on the respondent's smoking behaviors, personal characteristics, beliefs, and attitudes about smoking and health. These data were used to assess the potential for utilizing intervention resources in the

community. This dissertation utilizes the data related to the social psychological, demographic, environmental and behavioral variables as the variables pertain to the identification of groupings or categories of smokers.

Sampling and Data Collection

The research design for the study utilized a structured personal interview with a random sample of nonmetropolitan adults in two areas in the state of Iowa.

Nonmetropolitan areas were selected for research for a number of reasons. First, the 1960 census figures indicate that approximately 38 percent of the population of the United States resided outside of the 212 major population areas, the standard metropolitan statistical areas. Second, there is thought to be a difference in the values, attitudes, and beliefs held by "nonmetropolitan residents" when compared to "metropolitan residents". Smoking research has not previously utilized only nonmetropolitan samples. The samples had been either metropolitan or national in nature without a metropolitan-nonmetropolitan distinction reported. Thus, the third reason for using a nonmetropolitan sample was the need for data pertaining to residents in nonmetropolitan areas.

Iowa was selected as the nonmetropolitan area from which to draw the sample. Within the state of Iowa, it was decided to select two areas which were not contiguous, did not have a

city of 50,000 or more population, and which were dissimilar in as many respects as possible yet representative of the state of Iowa (see Figure 2).

The Iowa State University Extension Service has divided the state into sixteen areas and the two areas which were selected were drawn from these sixteen areas based on the above criteria (see Figures 3, 4). The two areas selected were NIAD, a northern areas consisting of Cerro Gordo, Floyd, Franklin, Hancock, Mitchell, Winnebago, and Worth counties in which the largest city is Mason City with a population of approximately 30,000 and a southern area, MIDCREST, consisting of Adair, Adams, Clarke, Decatur, Ringold, Taylor, and Union counties in which the largest city is Creston with a population of approximately 7,000 (see Figures 5, 6).

The universe for the study consisted of all adults over 21 residing in households in the open country or in towns with less than 25,000 population in the geographical areas of NIAD and MIDCREST.

Although interest was in individuals, the sampling frame, of necessity, was defined in terms of housing units. The general procedure was to decide how many adults were desired in the sample, to determine how many housing units would be needed to yield this number of adults, and then to draw a sample expected to give the necessary number of housing units. Approximately 200 interviews were desired in NIAD and

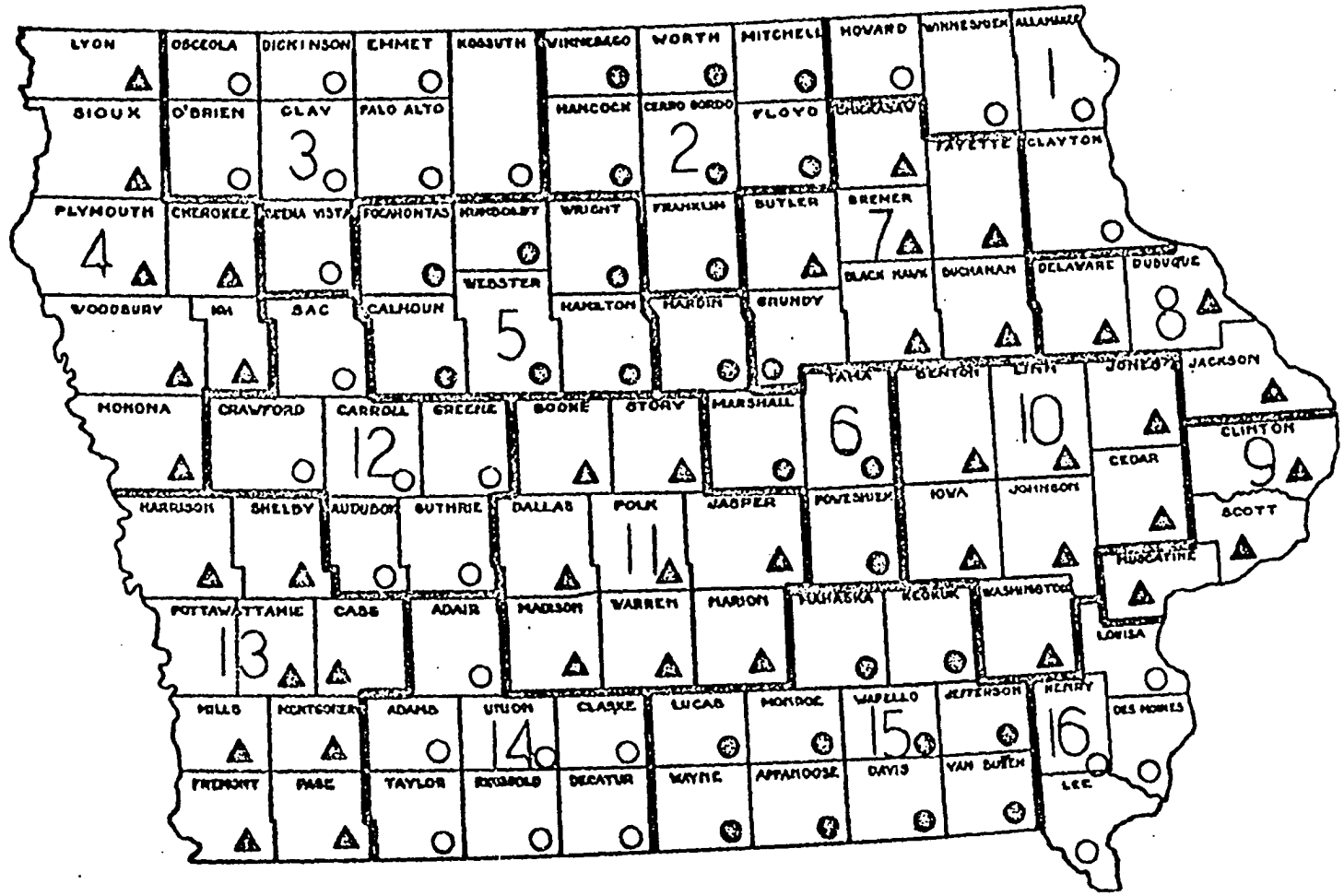


Figure 2. Areas with population designations (Iowa)

Note: ▲ = Metropolitan county

● = 10,000 - 49,000 population county

○ = Less than 10,000 population county

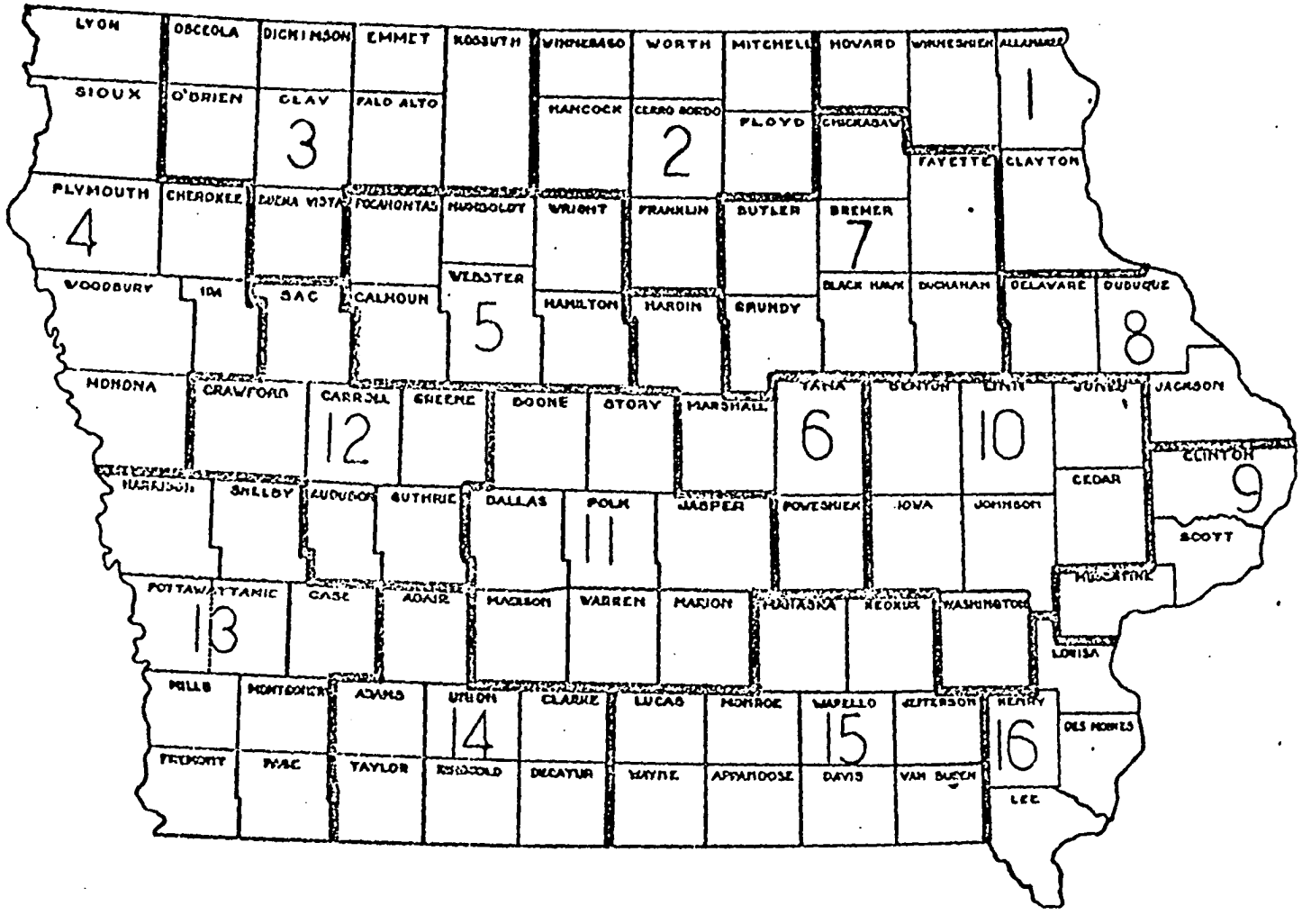


Figure 3. Extension administration areas (Iowa)

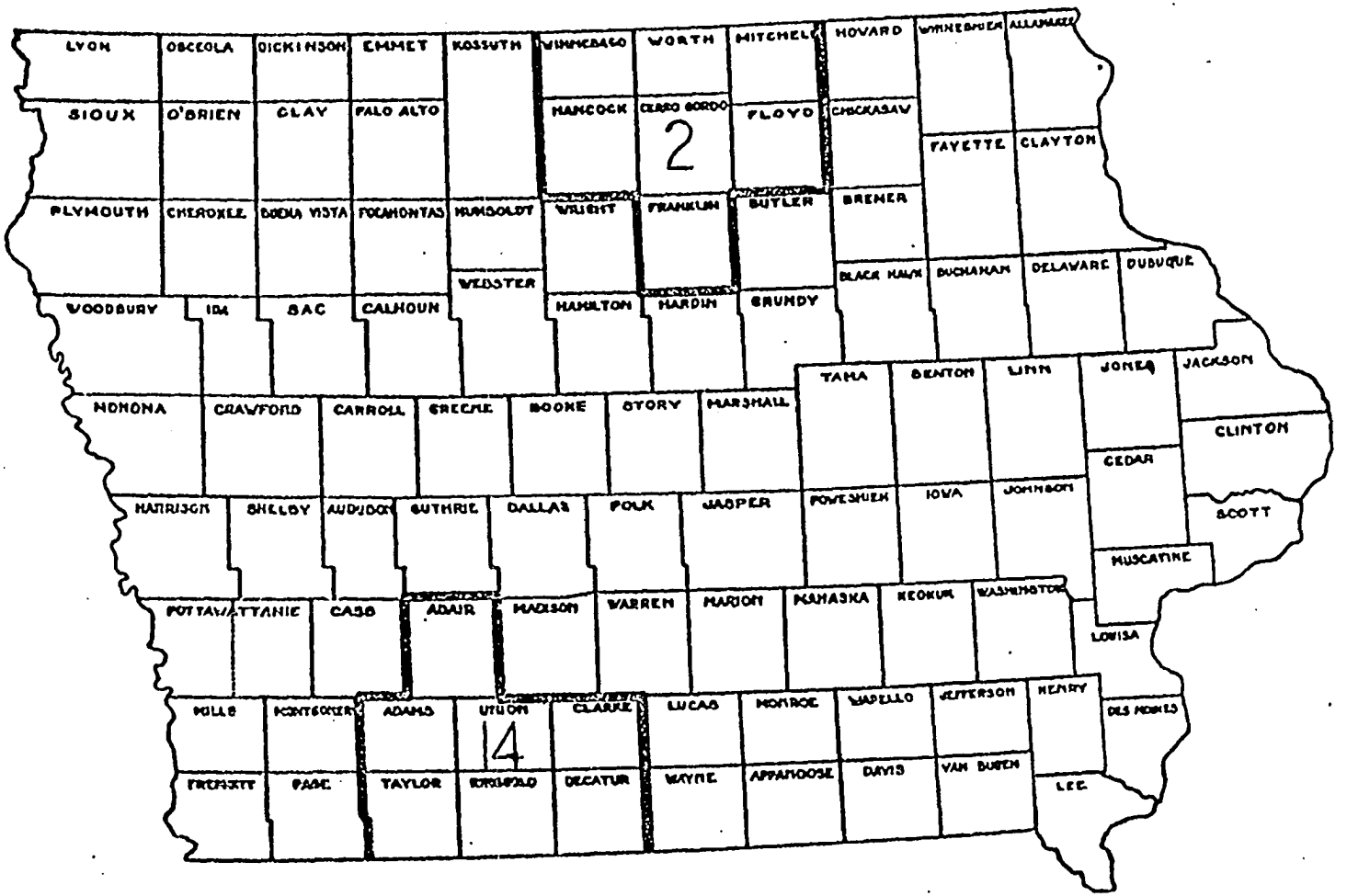


Figure 4. NIAD (2) and MIDCREST (14) areas (Iowa)

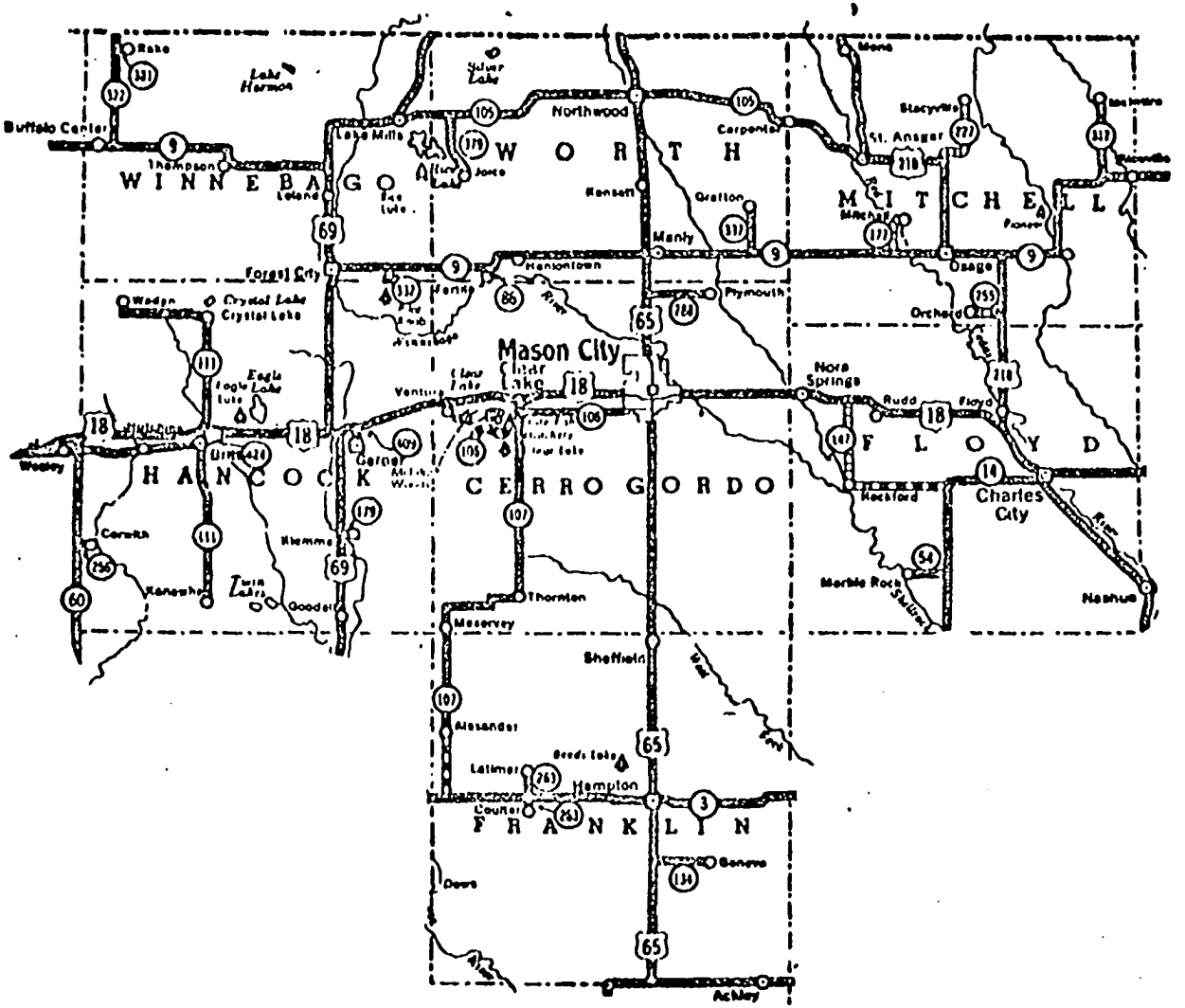


Figure 5. Map of NIAD development area (Iowa)

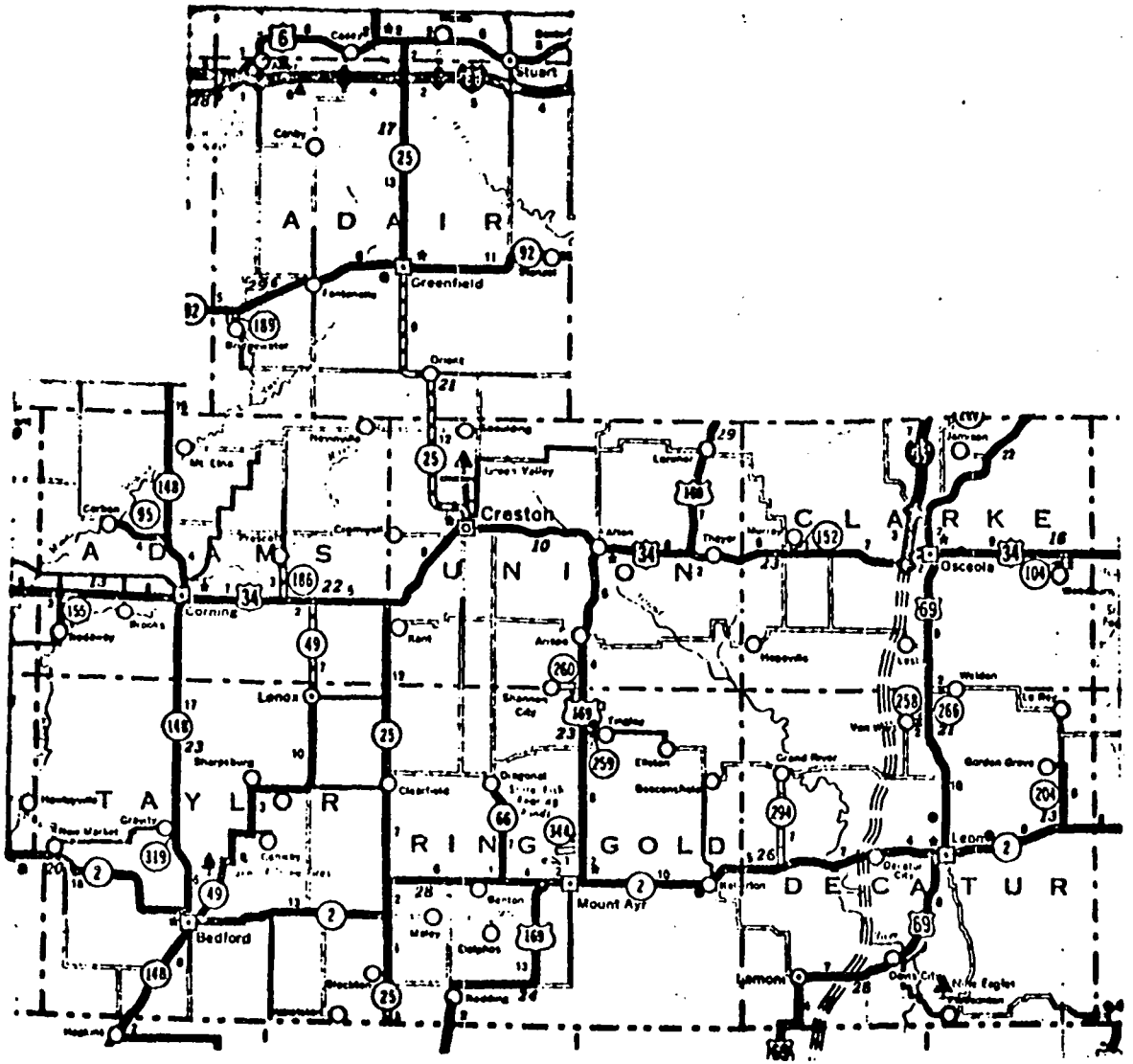


Figure 6. Map of MIDCREST development area (Iowa)

100 in MIDCREST. However, in order to reduce the frequency of having to obtain more than one interview from a given household, the individuals in the sample households were subsampled in a systematic manner at a rate of one-half. It was also desired to sample females who had never smoked (who, on the basis of national studies were thought to comprise about 30 percent of the adult population) at a lower rate than other adults. The nonsmoking women were subsampled at a rate of one-fourth rather than one-half. Since the sampling frame did not distinguish between vacant and occupied housing units it was necessary to make an allowance for occupancy rate (based on census data). Also, an allowance was made for nonresponse rate of 10 percent. Considering all these factors, a sample size was disignated which it was thought would yield the desired number of completed interviews.

The sampling procedure further consisted of selecting a stratified sample in each area. The strata were defined as follows:

1. Town with a population of 10,000 to 24,999 (an empty stratum in MIDCREST)
2. Town with a population 5,000 to 9,999
3. Towns with a population 2,500 to 4,999
4. Towns with population less than 2,500
5. Open country--any area not within the corporate bounds of a town or city.

Within each area, the sample was allocated to the strata proportional to their size in terms of total housing units (occupied and unoccupied). Within each stratum, the required number of households was selected in clusters or area segments of approximately six occupied and unoccupied housing units each. The sample from the open country was selected using materials from the Master Sample of Agriculture, each county being sampled in proportion to its size in terms of estimated housing units. The samples from the other strata were selected using aerial photographs or city directories. If the stratum contained only one town, the sample was selected in two stages--first selecting a sample of blocks with probability proportional to size and then selecting an area segment within each sample block. If the stratum contained more than one town, the sample of households was selected in three stages--first selecting a sample of towns with probability proportional to size, then a sample of blocks within each sample town, and, finally, a sample of households within each sample block. Subsampling of people within households, as previously discussed, added another stage to the sample design.

Within each area, the probability of being selected in the basic sample was the same for all males and for those women who were either current smokers or exsmokers. In order to randomly select males and females the following

procedure was utilized. Systematically, each segment within each stratum was given a number and each household in each segment was given a number. Adult males were interviewed only if they were in odd numbered households in even numbered segments or in even numbered households in odd numbered segments. Females who had never smoked were interviewed only if they lived in an odd numbered household in an even numbered segment.

The age, sex, and smoking criteria were utilized in the initial household contract to determine if there was a person in the household who qualified to be interviewed.

A trained staff of interviewers collected the data in September and October of 1969. A total of 328 respondents were interviewed. Table 3 presents the distribution of the respondents by sex for each of the smoker categories.

Table 3. Smoker categories by sex

Sex	Smoker Categories				
	Nonsmoker	Successful	Unsuccessful	No Attempt	Total
Male	51	64	46	25	186
Female	69	18	35	20	142
Total	120	82	81	45	328

CHAPTER V. FINDINGS AND CONCLUSIONS

Introduction

The preceding chapters have presented a description of the problem of audience delineation as it relates to planned social change and as it relates more specifically to the use of adoption stages. Also, the discussion focused on the relevance of demographic, social psychological, environmental and behavioral variables in determining if the smoking population is homogeneous or if there are categories that better represent the population. Finally, the problem of determining, statistically, if the categories do exist was discussed and the conclusion was reached that Stepwise Multiple Discriminant Function Analysis could be used to reduce the number of independent variables to a more efficient set and at the same time provide a means for testing the hypotheses that were developed. The purpose of this chapter is to present the findings as they relate to the use of the stepwise analysis and the test of the hypotheses. The results will be discussed according to the four categories: (1) All Categories, (2) Smoker Categories, (3) Current Smoker Categories, (4) Current Smoker Categories by Sex.

Hypotheses and Tests

This section presents the hypotheses that were developed in the preceding chapter, the statistical tests, and the results of the tests. A discussion of the findings follows the presentation and testing of the hypotheses. The reader is reminded that the Approximate F will be used to test the hypotheses which involve more than one pair of means and the F matrix values will be used to test the hypotheses which involves the equality of pairs of means.

General Hypothesis:

The audience toward whom smoking intervention programs might be directed is homogeneous.

Sub-general H_A: When a number of variables are considered simultaneously there is no difference between Nonsmoker, Successful, Unsuccessful, and No Attempt categories.

Sub-general H_B: When a number of variables are considered simultaneously there is no difference between Successful, Unsuccessful, and No Attempt categories.

Sub-general H_C: When a number of variables are considered simultaneously there is no difference between Unsuccessful and No Attempt categories.

Sub-general H_D: When a number of variables are considered simultaneously there is no difference between Male Unsuccessful, Female Unsuccessful, Male No Attempt and Female No Attempt categories.

The Empirical Null Hypotheses and the respective test statistics are presented in Table 5.

The independent variables that were used to test the Sub-general Hypotheses were obtained from the original pool of variables (Table 1). The Stepwise Multiple Discriminant Function Analysis procedure was used to reduce the original pool of variables to the set that discriminates among the groups in the four categorizations represented by the four Sub-general Hypotheses. Table 4 presents the variables used in the analyses, the variables that were finally selected by the stepwise procedure and the order in which the variables entered the stepwise analysis. It should be noted that the following variables:

Alternative like to use (X_{14})

Decision at present (X_{15})

Situation (X_{23})

Number of cigarettes smoked at heaviest (X_{24})

Number of cigarettes smoked at present (X_{25})

represent questions which were not asked of the Nonsmoker and Successful groups. As a result of this difference in question, the five variables were not used in the analyses of categories which contained either the Nonsmoker or Successful groups.

The F to enter level for each of the categories is also presented on Table 4. The F to enter for each of the

Table 4. Variables entered in the stepwise analyses

Variable Number	Variable Name	Categorizations and step entered into analysis			
		All Categories	Smokers	Current Smokers	Current Smokers by Sex
X_1	Education				
X_2	Age	Step 3	Step 3		Step 4
X_3	Number of People in Household				Step 3
X_4	Insurance				
X_5	Perceived Concern				
X_6	Major Health Problems				
X_7	Cause of Health Problems				
X_8	Aware Smokers Should Stop				Step 1
X_9	Think Smokers Should Stop				
X_{10}	Change of Acceptance in Community				
X_{11}	Situation Facilitates Smoking				
X_{12}	Change of Acceptance in General				
X_{13}	Sampling Strata				Step 5
X_{14}	Alternative Like to Use	-[a]	-[a]		
X_{15}	Decision at Present	-[a]	-[a]	Step 1	
X_{16}	Status of Head of Household				

[a]Variables represent questions which were not asked of the Non-Smoker or Successful groups and were therefore not used in the analysis of the category.

Table 4 (Continued)

Variable Number	Variable Name	Categorizations and step entered into analysis			
		All Categories	Smokers	Current Smokers	Current Smokers by Sex
X_{17}	Total number of Organizations a Member of				
X_{18}	Attitude - Restrictions on Sales and Advertising	Step 1	Step 1		
X_{19}	Attitude - Smoking and Health	Step 4	Step 2		
X_{20}	Attitude - Behavior of Exemplars	Step 2			
X_{21}	Attitude - Information on Smoking and Health				
X_{22}	Beliefs	Step 5			
X_{23}	Situation	-[a]	-[a]		
X_{24}	Number of Cigarettes Smoked at Heaviest	-[a]	-[a]		
X_{25}	Number of Cigarettes Smoked at Present	-[a]	-[a]		Step 2
	F to Enter	2.63	3.04	3.92	2.68
	d.f.	3/323	2/205	1/124	3/122

categorization is based on the F value at .05 at that point in the analysis immediately preceding the first step in the stepwise procedure. The degrees of freedom for the F to enter is defined as d.f. = g-1 and n-g-r. For the All Categories categorization before the first step (r) where r=0, with the number of groups (g) equal to four (4), and the

number of cases (n) equal to 328, the degrees of freedom equals 3 and 324. The F to enter at d.f. = 3/324 at .05 is 2.63. The values of F to enter for the other three categorizations are also presented in Table 4.

Results of tests

Nineteen (19) empirical hypotheses were tested. Four of these hypotheses involved the test of overall equality of means and 15 of the hypotheses involved the test of equality of means between pairs of groups. Three of the four tests of overall equality of means resulted in the lack of support of the null hypotheses of no difference between group means. The null hypotheses that was tested for overall equality of means and was not reported was the hypothesis that pertained to the current smoker categories. The support of the null hypotheses for this categorization resulted from the fact that the stepwise analysis produced only one variable with an F to enter that met the minimum criterion at the .05 level of significance.

As a result of the testing the four hypotheses concerned with the overall equality of means for groups the following null hypotheses were not accepted:

Table 5. Empirical null hypotheses and test statistics

Empirical Hypotheses	No. of Categories	No. of Cases	No. of Variables Used in Analysis	Approximate F Statistic	d.f. = rq and ms + 1 - rq/2
ALL CATEGORIES					
$EH_{A_1}: \mu_1=\mu_2=\mu_3=\mu_4$	4	328	5	8.73616**	15/883.78
$EH_{A_2}: \mu_1=\mu_2$	4	328	5	-	-
$EH_{A_3}: \mu_2=\mu_3$	4	328	5		-
$EH_{A_4}: \mu_3=\mu_4$	4	328	5	-	-
$EH_{A_5}: \mu_1=\mu_3$	4	328	5	-	-
$EH_{A_6}: \mu_1=\mu_4$	4	328	5	-	-
$EH_{A_7}: \mu_2=\mu_4$	4	328	5	-	-
SMOKER CATEGORIES					
$EH_{B_1}: \mu_2=\mu_3=\mu_4$	3	208	3	9.84950**	6/406
$EH_{B_2}: \mu_2=\mu_3$	3	208	3	-	-
$EH_{B_3}: \mu_3=\mu_4$	3	208	3	-	-
$EH_{B_4}: \mu_2=\mu_4$	3	208	3	-	-
CURRENT SMOKER CATEGORIES					
$EH_{C_1}: \mu_3=\mu_4$	2	126	1[a]	-	-

[a]Indicates that the number of variables entered in the step wised analysis was not equal to or greater than the number of groups and therefore statistical tests were not appropriate.

**Indicates null hypothesis not supported at .01 level.

Tabular $F_{.05}$	Tabular $F_{.01}$	F Matrix Statistic	d.f. = r and n-r+1	Tabular $F_{.05}$	Tabular $F_{.01}$
1.53	1.81	-	-	-	-
-	-	1.99472	5/320	2.24	3.08
-	-	9.44667**	5/320	2.24	3.08
-	-	1.52686	5/320	2.24	3.08
-	-	18.53208**	5/320	2.24	3.08
-	-	14.84154**	5/320	2.24	3.08
-	-	8.70136**	5/320	2.24	3.08
2.12	2.85	-	-	-	-
-	-	14.87528**	3/203	2.65	3.88
-	-	2.03424	3/203	2.65	3.88
-	-	12.60812**	3/203	2.65	3.88
-	-	-	-	-	-

Table 5 (Continued)

Empirical Hypotheses	No. of Categories	No. of Cases	No. of Variables Used in Analysis	Approximate F Statistic	d.f. = rq and ms + 1 - rq/2
CURRENT SMOKER BY SEX CATEGORIES					
EH_{D_1} : $\mu_{13}=\mu_{23}=\mu_{14}=\mu_{24}$	4	126	5	3.79817**	15/326.15
EH_{D_2} : $\mu_{13}=\mu_{23}$	4	126	5	-	-
EH_{D_3} : $\mu_{23}=\mu_{14}$	4	126	5	-	-
EH_{D_4} : $\mu_{14}=\mu_{24}$	4	126	5	-	-
EH_{D_5} : $\mu_{13}=\mu_{14}$	4	126	5	-	-
EH_{D_6} : $\mu_{13}=\mu_{24}$	4	126	5	-	-
EH_{D_7} : $\mu_{23}=\mu_{24}$	4	126	5	-	-

*Indicates null hypothesis not supported at .05 level.

Tabular $F_{.05}$	Tabular $F_{.01}$	F Matrix Statistic	d.f. = r and n-r+1	Tabular $R_{.05}$	Tabular $R_{.01}$
1.68	2.07	-	-	-	-
-	-	3.32933**	5/118	2.29	3.17
-	-	3.83221**	5/118	2.29	3.17
-	-	7.35623**	5/118	2.29	3.17
-	-	2.61080*	5/118	2.29	3.17
-	-	5.38621**	5/118	2.29	3.17
-	-	2.22741	5/118	2.29	3.17

All categories:

EHO_{A_1}: $\mu_1 = \mu_2 = \mu_3 = \mu_4$

Smoker Categories:

EHO_{B_1}: $\mu_2 = \mu_3 = \mu_4$

Current Smoker Categories by Sex:

EHO_{D_1}: $\mu_{13} = \mu_{23} = \mu_{14} = \mu_{24}$

Whereas, the empirical null hypothesis for the

Current Smoker Categories:

EHO_{C_1}: $\mu_3 = \mu_4$

was not rejected.

When the results of empirical null hypotheses postulating equality between pairs of group means are considered the findings indicate that four of the six All Categories null hypotheses, two of the three Smoker Categories null hypotheses, and five of the six Current Smokers by Sex null hypotheses were not accepted.

The results of the tests of the empirical hypotheses lead to the conclusion that the variables entered in the stepwise analyses of the categorization of All Categories, Smokers, and Current Smokers by Sex, do discriminate among the groups and that the group means are not all estimates of a common population mean.

Further, it is suggested that consideration should be given to treating the cigarette smoking population as different populations rather than treating it as a singular or homogeneous population.

Even though a majority of the null hypotheses concerned with equality of means between pairs of groups were not accepted some consideration should be given to exploring those null hypotheses which were supported. Table 6 presents the F matrices for the three categorizations, All Categories, Smoker Categories and Current Smoker by Sex. Presentation of the findings of the tests of the hypotheses pertaining to equality of means for pairs of group in matrix form makes the findings easier to compare.

When considering the hypotheses pertaining to differences between groups in the All Categories and Smoker Categories, the Nonsmoker and Successful group means ($\mu_1=\mu_2$) and the Unsuccessful and No Attempt group means ($\mu_3=\mu_4$)do not differ more than would be expected by chance at the .05 level of significance. It appears that there may be an underlying continuum. That continuum may take the form:

Nonsmoker ↔ Successful ↔ Unsuccessful ↔ No Attempt

where the relative distance between the categories may be inferred from the findings.

More insight into the nature of the overlap of the groups

Table 6. F-Matrices from stepwise analysis

A. All Categories Matrix

	Nonsmoker (X_1)	Successful (X_2)	Unsuccessful (X_3)
Successful (X_2)	1.99472	9.44667	
Unsuccessful (X_3)	18.53208	88.70136	1.52686
No Attempt (X_4)	14.84154		

$F_{.05}$ 5/320=2.24

B. Smokers Matrix

	Successful (X_2)	Unsuccessful (X_3)
Unsuccessful (X_3)	14.87528	
No Attempt (X_4)	12.60812	2.03424

$F_{.05}$ 3/203=2.65

C. Current Smokers Matrix

Number of variables entered in stepwise analysis did not meet $p \geq g$ criterion, therefore F Matrix not appropriate

D. Current Smoker Categories by Sex Matrix

	Male Unsucces. (X_{13})	Female Unsucces. (X_{23})	Male No Attempt (X_{14})
Female Unsuccessful (X_{23})	3.32933		
Male No Attempt (X_{14})	2.61080	3.83221	
Female No Attempt (X_{24})	5.38621	2.22741	7.35623

$F_{.05}$ 5/118=2.29

within the All Categories and Smoker Categories is provided by a "Confusion Matrix". Massy indicates that "since it is known beforehand which group the person actually belongs to, we can prepare a table of correct or incorrect classifications" (1965). This matrix of correct and incorrect classifications is called the "confusion matrix". The figures along the diagonal indicate the number of persons classified correctly ("Hits") and the off-diagonal numbers represent the number of persons misclassified. The figures along the off-diagonals also indicate the category in which the misclassifications are most likely to occur for any given group. Since the number of persons in the groups vary, Massy indicates that it is easier to "draw conclusions from the confusion matrix if we normalize the raw misclassification counts by dividing each by its row total" (1965: 42). Tables 7 through 12 present the raw score and normalized confusion matrices for the categorization of: All Categories, Smoker Categories and Current Smokers by Sex.

The data in Table 8 indicate that more of the Nonsmoker are likely to be classified as Successful (.225) than either of the other categories and more of the Successful are likely to be classified as Nonsmokers, (.317) than either of the other categories. Similarly, the data in Table 8 indicate that more of the Unsuccessful are likely to be classified as

Table 7. Confusion matrix for five (5) variables, assuming equal probabilities (All Categories)

	Nosmkr (μ_1)	Succes (μ_2)	Unsucs (μ_3)	Attnot (μ_4)	Total
Nosmkr (μ_1)	67	27	15	11	120
Succes (μ_2)	26	32	11	13	82
Unsucs (μ_3)	8	17	28	28	81
Attnot (μ_4)	6	6	8	25	45

Total Hits = 152 Percent Hits = 46.34%

Table 8. Normalized confusion matrix for five (5) variables, assuming equal probabilities (All Categories)

	Nosmkr (μ_1)	Succes (μ_2)	Unsucs (μ_3)	Attnot (μ_4)	Total
Nosmkr (μ_1)	.558	.225	.125	.092	1.00
Succes (μ_2)	.317	.390	.134	.158	1.00
Unsucs (μ_3)	.133	.133	.178	.556	1.00

Table 9. Confusion matrix for three (3) variables, assuming equal probabilities (Smoker Categories)

	Succes (μ_2)	Unsucs (μ_3)	Attnot (μ_4)	Total
Succes (μ_2)	58	15	9	82
Unsucs (μ_3)	17	39	25	81
Attnot (μ_4)	9	12	24	45

Total Hits = 121 Percent Hits = 58.17%

Table 10. Normalized confusion matrix for three (3) variables, assuming equal probabilities (Smoker Categories)

	Succes (μ_2)	Unsucs (μ_3)	Attnot (μ_4)	Total
Succes (μ_2)	.707	.183	.110	1.00
Unsucs (μ_3)	.210	.481	.309	1.00
Attnot (μ_4)	.200	.267	.533	1.00

Table 11. Confusion matrix for five (5) variables, assuming equal probabilities (Current Smoker Categories by Sex)

	Male Unsucs (μ_{13})	Female Unsucs (μ_{23})	Male Attnot (μ_{14})	Female Attnot (μ_{24})	Total
Male Unsucs (μ_{13})	19	6	12	9	46
Female Unsucs (μ_{23})	10	10	6	9	35
Male Attnot (μ_{14})	6	4	13	2	25
Female Attnot (μ_{24})	1	3	1	15	20

Total Hits = 57 rcent Hits = 45.23%

Table 12. Normalized confusion matrix for five (5) variables, assuming equal probabilities (Current Smoker Categories by Sex)

	Male Unsucs (μ_{13})	Female Unsucs (μ_{14})	Male Attnot (μ_{23})	Female Attnot (μ_{24})	Total
Male Unsucs (μ_{13})	.413	.130	.261	.196	1.00
Female Unsucs (μ_{14})	.286	.286	.171	.257	1.00
Male Attnot (μ_{23})	.240	.160	.520	.080	1.00
Female Attnot (μ_{24})	.050	.150	.050	.750	1.00

No Attempt (.309) than as Successful and more of the No Attempt are likely to be classified as Unsuccessful (2.67) than as Successful. The lowest proportion of misclassifications involves the Nonsmoker and No Attempt categories .092 and .133 and when the Non-Smoker group is omitted from the analysis as is the case for the Smokers Categories, Table 9 and Table 10, the lowest proportion of misclassifica-

tion occurs between Successful and No Attempt groups (.110 and .200). These low proportions of misclassification follow what would be expected given the magnitude of the values on the F matrices, Table 6 (A) and (B), indicating a larger difference between group means than would be expected by chance. The tests of the hypotheses pertaining to the equality of means between groups for the Current Smoker Categories by Sex reveal that only one of the null hypothesis was not rejected. That hypothesis ($\mu_{23}=\mu_{24}$) was the one that hypothesized no difference between the group means for Female Unsuccessful and Female No Attempt groups. The data in Table 12 presenting the Normalized Confusion Matrix for Current Smoker Categories by Sex indicate that there is misclassification both by sex and by smoker category. The insignificant F value for $\mu_{23} = \mu_{24}$ is .064 from being significant at the .05 level. The difficulties in exploring the pattern of misclassification may be due to the combination of two dimensions in one categorization (Sex and Current Smoker Categories) and the fact that the Calculated F value very nearly meets the .05 level of significance. The closeness of the calculated F to the tabular F moves one in the direction of concluding that the difference between the group means may not be due to chance and the 75% correct classification adds credibility to that possibility.

Results of stepwise analysis

It has been indicated above that consideration should be given to treating the cigarette smoking population as different populations rather than treating it as a homogeneous population. This consideration is based on the findings that 15 of the 19 empirical null hypotheses were not supported. A question can appropriately be raised concerning the identification of the independent variables which when combined produced the discrimination among the groups. Table 4 presents the original pool of variables and the ones which were entered in the stepwise analysis. Table 13 presents only those variables that did meet the minimum F to enter and those that were added in the analysis to the point where the F values became insufficient for further computation.

Conspicuous by their absence from the inclusion in the stepwise analysis are the "environmental" variables. Schwartz and Dubitzky indicate that one of the factors they found to be "important in behavior change is the 'total environment'" (1969: 1399). Straits also found an "environmental" variable (wife who smokes) to be useful in discriminating between "quitters" and "smokers" (1967: 80). Graham and Gibson refer to the work of Redfield, Lenton and Hurskovits in suggesting the importance "of the acceptance or rejection behavior of persons in the subjects' milieu in influencing his change to

Table 13. Variables entered in stepwise analysis

Type of Variable	Variable Number	Variable Name	Categorization and step number which indicates order of variables entrance into analysis			
			All Categories	Smokers	Current Smokers	Current Smoker Categories by Sex
D	X_2	Age	Step 3	Step 3		Step 4
D	X_3	Number of People in Household				Step 3
SP	X_8	Aware Smokers Should Stop				Step 1
D	X_{13}	Sampling Strata				Step 5
B	X_{15}	Decision at Present			Step 1	
SP	X_{18}	Attitude-Restrictions on Sales and Advertising	Step 1	Step 1		
SP	X_{19}	Attitude-Smoking and Health	Step 4	Step 2		
SP	X_{20}	Attitude-Behavior of Exemplars	Step 2			
SP	X_{22}	Beliefs	Step 5			
B	X_{25}	Number of Cigarettes Smoked at Present				

F to enter
d.f.

Variable Type:
B = Behavioral Variable
D = Demographic Variable
SP= Social Psychological Variable

accept or reject" (1967: 5). The absence of "Environmental" variables not withstanding, there are demographic, social psychological and behavior variables which do discriminate among the groups.

Attitudes (X_{18}, X_{20}, X_{19}) and Beliefs (X_{22}) along with Age (X_2) entered the stepwise analysis for the All Categories Hypothesis and Attitudes (X_{18}, X_{19}) and Age (X_2) entered the analysis for the Smoker Categories Hypothesis. The data in Table 14 presents the means and standard deviations on the five variables used to discriminate among the groups in the All Categories analysis. These data indicate that Nonsmokers and Successful categories tend to be older (X_2), more favor able toward governmental restrictions on sales and advertising of cigarettes (X_{18}), less favorable toward smoking and continuing smoking (X_{19}), more favorable toward exemplars providing nonsmoking role model (X_{20}) and more certain that cigarette smoking is related to health problems (X_{22}).

When the means and standard deviations of the variables entered in the stepwise analysis of the Smokers Categories are considered the same trend that was found in the All Categories analysis is apparent on Table 15. It should be noted that since the variables that were entered in the Smokers Categories analysis are three of the final variables that were used in the All Categories analysis, the values of the group means and standard deviations were not changed by

Table 14. Means and standard deviations for five (5) variables entered in stepwise analysis (All Categories)

Independent Variables	Nosmkr	Succes	Unsucs	Attnot	Total
			Means		
Age (X_2)	4.180	4.061	3.247	3.333	3.777
Attitude-Restrictions on Sales and Advertising (X_{18})	78.417	73.792	54.555	56.022	68.296
Attitude-Smoking and Health (X_{19})	39.125	44.036	59.654	71.155	49.817
Attitude Behavior of Exemplars (X_{20})	69.325	66.220	54.765	51.489	62.506
Beliefs (X_{22})	33.392	34.354	31.716	30.356	32.802
			Standard Deviations		
Age (X_2)	1.699	1.673	1.562	1.638	
Attitude-Restrictions on Sales and Advertising (X_{18})	19.417	20.518	20.033	20.450	
Attitude-Smoking and Health (X_{19})	27.442	31.128	29.417	34.760	
Attitude-Behavior of Exemplars (X_{20})	11.730	15.149	19.654	22.091	
Beliefs (X_{22})	6.098	5.320	6.087	5.523	

Table 15. Means and standard deviations for three (3) variables entered in stepwise analysis (Smoker Categories)

Independent Variables	Succes	Unsucs	Attnot	Total
		Means		
Age (X_2)	4.061	3.247	3.333	3.586
Attitude-Restrictions on Sales and Advertising (X_{18})	73.792	54.555	56.022	62.457
Attitude-Smoking and Health (X_{19})	44.036	59.654	71.155	55.986
		Standard Deviations		
Age (X_2)	1.673	1.562	1.638	
Attitude-Restrictions on Sales and Advertising (X_{18})	20.518	20.033	20.450	
Attitude-Smoking and Health (X_{19})	31.128	29.417	34.760	

Table 16. Means and standard deviations for five (5) variables entered in stepwise analysis (Current Smoker Categories by Sex)

Independent Variables	Male Unsucs	Female Unsucs	Male Attnot	Female Attnot	Total
			Means		
Age (X_2)	3.587	2.800	3.800	2.650	3.277
Number of People in Household (X_3)	3.217	3.714	3.560	2.650	3.333
Aware Smokers Should Stop (X_8)	1.739	1.857	1.480	1.900	1.746
Sampling Strata (X_{13})	1.848	2.228	1.760	2.700	2.071
Number of Cigarettes Smoked at Present (X_{25})	3.022	2.343	2.560	2.350	2.635
			Standard Deviations		
Age (X_2)	1.641	1.346	1.590	1.461	
Number of People in Household (X_3)	1.474	1.426	1.781	1.461	
Aware Smokers Should Stop (X_8)	0.444	0.355	0.510	0.508	
Sampling Strata (X_{13})	1.154	1.215	1.012	1.218	
Number of Cigarettes Smoked at present (X_{25})	1.022	0.765	1.261	0.745	

dropping one group from the analysis. As in the All Categories analysis the Successful group tends to be older (X_2), more favorable toward governmental restrictions on sales and advertising of cigarettes (X_{18}) and less favorable toward smoking and the continuation of cigarette smoking (X_{19}) than the Unsuccessful and No Attempt groups.

When the data pertaining to analysis of Current Smoker Categories by Sex are considered, three points can be made. The first, the means and standard deviation data in Table 16 make it difficult to discern a pattern. As a result, the means of the groups for the five variables have been plotted on Figure 7. the second point is that males tend to follow a similar profile whereas the Female Unsuccessful and Female No Attempt groups are quite different on the "Number of people in the household" (X_3) and on the "Sampling strata" (X_{13}). In addition to having a lower mean for the "Number of people in the household" and higher mean for Sampling strata" which indicates a less rural place of residence - the Female Unsuccessful tend to be slightly younger (X_2) than the Female No Attempt.

The third point relates to the awareness of the message that smokers should stop smoking (X_8). The finding that Male No Attempts have the lowest mean value on the awareness variable begins to indicate that there may be some validity in the sequence of the adoption stages in that awareness is

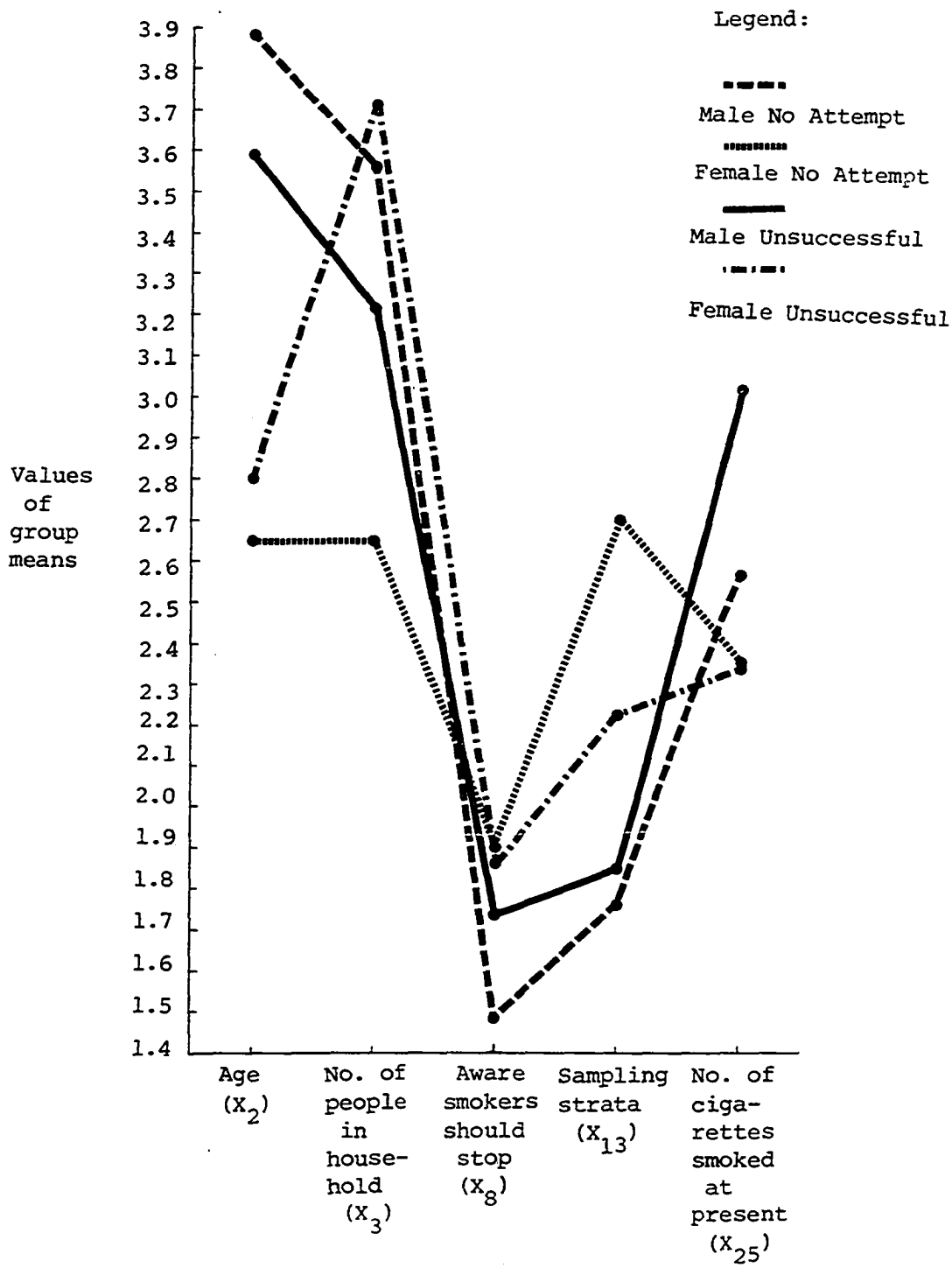


Figure 7. Profiles of current smoker by sex categories using group means for the five (5) variables entered in the stepwise analysis

prerequisite for adoption. But, the Female No Attempt with the highest mean value on the awareness variable detracts from this finding. The point that can be made is that discriminant function analysis offers a tool for the exploration and further testing of the adoption stages.

It should be noted that the means and standard deviations presented in Tables 14-16 were produced by the stepwise discriminant function analysis and provide the basis for the discriminant functions as well as the confusion matrices. In addition, the means provide the basis for the tests of the hypothesis concerning differences among categories.

Use of the findings

The importance of relationship between planned change and the need to know the audience toward whom the change efforts are to be directed was discussed in Chapter II. The point can be made that one of the reasons for the interest in identifying the audience or audiences which were to be the focal point of the change efforts is to determine their characteristics of the audiences. This kind of identification is particularly relevant if the variables that are used are those that appear to be directly related to the change that is desired. It is even more useful if those variables are variables that are manipulatable. A set of variables that not only discriminates among the groups but includes variables that are

manipulatable would not only describe individuals and separate them into groups, but also provide a starting point for the development of intervention programs. The stepwise analyses used herein have included variables that provide description of the groups but some of the variables are also of the manipulatable type. The Awareness (X_8) Attitude (X_{18}, X_{19}, X_{20}) and the Belief (X_{22}) variables are examples of the kind of variables that not only describe the groups but can be manipulated by the change agent. The variables are also ones that are directly related to the problem of cigarette smoking cessation. Therefore, the stepwise multiple discriminant function analysis has apparently provided a set of variables that discriminate among groups with various cigarette smoking behaviors and has produced a set of variables that may provide a starting point for the development of cigarette smoking intervention programs based on the identification and description of these groups.

When one considers the findings of the analysis related to the current Smokers by Sex categories as these findings pertain to the development of cigarette smoking intervention programs the following points are among the most important for change agents to note.

The Current Smokers by Sex categories represents the population which would be the target of cigarette smoking intervention efforts. The data used in the Current Smokers by

Sex categories represent only those persons who were cigarette smokers at the time of the interviews. The data does not represent those who had not smoked cigarettes or those who had smoked cigarettes and had stopped smoking cigarettes before the interviews.

The stepwise analysis delineated the variables that discriminate, the test of the hypotheses provided the basis for conclusing that it is advisable to treat the categories as separate populations, and the group means provide data for describing the profiles of the categories on the variables selected by the stepwise process. Given that the Current Smokers by Sex categories represent different populations toward which intervention efforts might be directed and that the findings show that Age (X_2), number of people in Household (X_3), Aware Smokers Should Stop (X_8), Smoking Status (X_{13}), and Number of Cigarettes Smoked at Present (X_{25}) are the variables that discriminate among the categories at the .05 level of significance, the question can appropriately be asked, "How can this information help in the development of an intervention program?"

While no attempt will be made to describe or explain the operations of intervention programs that might be directed toward the current cigarette smokers, it can be pointed out how the findings offer the change agent a tool for program development. While there are those more familiar than this

writer with the nature of cigarette smoking intervention "theory" the following is an attempt to illustrate how the findings might be used.

First, the change agent should consider at a general level the point that there has been a statistically significant discrimination that has been found to exist among the current smokers.

Second, discrimination is represented by a categorization that consists of the dimension of attempt to stop smoking (made an attempt or has not made an attempt) and dimension of sex (male/female). When combined, these two dimensions have been found to represent different populations. Thus, the change agent should assess the nature of the categories before concentrating on the variables that were the ones that discriminated. This point refers to the thesis for the dissertation. Namely, that there is a need to determine whether there is one audience toward whom one is to direct his efforts or that the mass that is assumed to be homogeneous is in fact comprised of a number of populations. Having found that there are audiences, the change agent can then move on to the description of the variables that discriminated and those that do not discriminate.

One of the advantages of using multiple discriminant function analysis over tabular analysis is that it allows for the analysis of a large number of variables more or less

simultaneously. One of the results of this is that the profiles that are developed of the groups or categories are multivariate profiles and not the "adding up" of cross tabular data without knowing whether or not the variables that are being "added" do in fact discriminate among the categories. This leads to the second point concerning the ways that findings provide a tool for the change agent. That point is that not only does the change agent know that there are different audiences, he knows the variables on which those differences exist and the means of the variables for each of the categories. It is granted that the variables that were selected by the stepwise process represent those that have come from a finite population of variables. Nevertheless, the variables do discriminate and it is at this stage in the change agents process of using the findings that this "theoretical" knowledge about the subject matter must come into play.

It is assumed that there is probably a "weakness" in the "theory" for if there was not, the discriminatory analysis would not have been used as an explanatory procedure using a stepwise analysis but would have been used with a specific variable to test the hypothesis that those specific variables discriminated among the categories and then move to the determination of the means of the categories of the variables so as to describe the categories in a multivariate sense.

A very important point for a change agent to remember when

considering the findings of a step wise discriminant function analysis is to look at those variables that did not discriminate. The variables that were not entered into the stepwise analysis were not entered for a reason, namely, they did not differentiate among the groups at a given level of probability. Thus, the audience is assumed to be generally more homogeneous on those variables not entered than on those variables entered. The change agent should review the variables that did not enter the analysis for the should provide some indication of the similarity of the groups.

Suggestions for Future Research

The topics of development, planned change, and social intervention have been increasing in their prominence in the social science literature. The various change programs all have some unit as the focus of the change. The point can be made that the development of successful change effort can use the points that have been learned from past efforts as a guide. The suggestion can be made that the data concerning the efforts that have been made to bring about social change be analyzed, where appropriate, using multiple discriminant analysis. This technique provides a means for testing whether the unit is empirically like other units that, on the surface, it appears to be like. Specific instances of application might be the determination of the existence of Voluntary,

Public, Professional and Interorganizational organizational types in a multivariate sense or the analysis of the voluminous data pertaining to the research on adoption stages.

Researchers are too often tied to one analysis technique for it is all that they know rather than exploring other techniques that might be more appropriate for the research situation. Multiple discriminant function analysis provides one more alternative for multivariate analysis. And, while it is particularly useful for situations where dependent variables are dichotomous, Maxwell points out that "the discriminant function analysis has been in common use in the behavioral sciences for dealing with problems of identification and classification when the variates are continuous" (1961b). The "common use" that is referred to includes examples from psychology and genetics - sociology is notably absent from his references. The absence seems to be due more to the reliance on other statistical techniques and not so much on the fact that sociology does not have problems for which Multiple Discriminant Function Analysis would be appropriate and useful.

CHAPTER VI. SUMMARY

The combination of the problem of audience delineation and a multivariate analysis technique that can be used on categorical dependent variables provided the problematic basis for this dissertation. More specifically the General Hypothesis that postulated that "the audience toward whom smoking intervention programs might be directed is homogenous" provided the opportunity to explore the use of Multiple Discriminant Function Analysis as a technique for audience delineation.

Two types of objectives provided the focus of the dissertation. First, the exploratory objective was concerned with the reduction of a large number of variables to a relatively small number of variables that would discriminate among audiences and test the "homogeneity of audience" hypotheses. The second objective is the descriptive objective and focuses on the description and use of Stepwise Multiple Discriminant Function Analysis as it can be used on the problem of audience delineation.

The process of meeting the objectives began with the discussion of the analytic and conceptual frameworks. Smoking behavior intervention was identified as a specific instance of planned change and the adoption process was used as part of the frame of reference for identifying the audience which

might serve as the focus of intervention programs.

The discussion of the adoption process lead to the description of the nominal level of measurement. This discussion was followed by a discussion of multivariate analysis. The discussion of multivariate analysis concluded that there are three major criteria that are relevant for the selection of an appropriate analysis technique: (1) level of measurement of the date of both the dependent and independent variables, (2) the type of analysis to be used - univariate or multivariate, and (3) whether the analysis is to be a dependence or interdependence type of analysis. The discussion of nominal level of measurement and the multivariate analysis provided the basis for the discussion and description of the Stepwise Multiple Discriminant Function Analysis procedure used for the analyses.

The Conceptual Framework chapter presented a review of some of the literature regarding some of the research done on smoking intervention in order to arrive at a set of dependent and independent variables for use in the analysis. The dependent variable concerns smoking behavior and is represented by four groups: Nonsmokers, Successful, Unsuccessful and No Attempt. The Unsuccessful and No Attempt categories were further separated into Male Unsuccessful, Female Unsuccessful, Male No Attempt and Female No Attempt.

The independent variables were grouped into four types:

Demographic, Environmental, Social Psychological and Behavioral. The four types of variables that have been used in other smoking behavior studies particularly those of Schwartz and Dubitzky (1969) and Horn (1966: 1968). The variables also are based on the theoretical approaches to mass communication as reviewed by DeFleur (1971).

The general hypothesis was explicated to four Subgeneral Hypotheses. The hypotheses and findings are as follows:

Sub-Gen Ho_A: When a number of independent variables are considered simultaneously there is no difference between Nonsmoker, Successful, Unsuccessful and No Attempt Categories.

When tested for overall difference of group means this hypothesis was not supported.

Sub-Gen Ho_B: When a number of independent variables are considered simultaneously there is no difference between Successful, Unsuccessful and No Attempt categories.

When tested for overall difference of group means this hypothesis was not supported.

Sub-Gen Ho_C: When a number of independent variables are considered simultaneously there is no difference between Unsuccessful and No Attempt categories.

This hypothesis was supported.

Sub-Gen Ho_D: When a number of independent variables are considered simultaneously there is no difference between Male Unsuccessful, Female Unsuccessful, Male No Attempt and Female No Attempt categories.

When tested for overall differences of group means this hypothesis was not supported.

The findings indicate that the Demographic and Social Psychological types of variables are the ones that discriminated among the groups. The point that the social psychological variables not only relate to smoking but offer the potential for manipulation by a change agent presents a point of departure for the development of making intervention programs.

The findings indicate that the cigarette smokers in non-metropolitan Iowa are not represented as one population but that there are differences between the categories of smokers as postulated in the hypotheses.

Finally, the dissertation concluded with the point that Multiple Discriminant Function Analysis offers a technique for use in other classification problems like organization types as well as stages in the adoption process.

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ACKNOWLEDGMENTS

The writing of a dissertation involves contact with and assistance from many people. I would like to publicly thank several of those people.

First, my appreciation is expressed to Dr. George M. Beal for serving as chairman of my graduate committee. The value of the encouragement and guidance provided by Dr. Beal throughout my graduate career has been immeasurable.

Appreciation is also expressed to Dr. Richard D. Warren for his assistance with the statistical and methodological portion of this dissertation and for his personal interest and encouragement provided to me during my graduate career. Appreciation is also expressed to Dr. Joe M. Bohlen for serving on my graduate committee and for stimulating my interest in research.

I also wish to express my appreciation for the comments and assistance provided by Dr. Margaret I. Liston and Dr. Ronald C. Powers and for the time taken from their busy schedules to serve as members of my graduate committee.

Dr. Donald G. McTavish also deserves an expression of appreciation for his assistance in setting up the computer program used in the analysis of the data.

Finally, my most sincere expression of appreciation goes to Elsie Elmore for her assistance in the draft typing and to

my wife, Anne, without whose encouragement, assistance and tolerance this dissertation would probably still be in the "conceptual" stage.

APPENDIX A

Stepwise Multiple Discriminant Function Analysis: Computation Procedures

COMPUTATIONAL PROCEDURE: (Dixon, 1971)

Notation: p = number of variables
g = number of groups used for the analysis. This excludes those with negative group size
t = total number of groups
n_m = number of cases in group m
n = total number of cases
x_{mki} = value of variable i for case k of group m

Assume for simplicity that the first g of the t groups are used for the analysis.

Step 1: The data are read and the following are formed:

$$\text{Means } \bar{x}_i = \frac{1}{n} \sum_{m=1}^{g} \sum_{k=1}^{n_m} x_{mki} \qquad i = 1,2,\ldots,p$$

$$\text{Group means } \bar{x}_{mi} = \frac{1}{n_m} \sum_{k=1}^{n_m} x_{mki} \qquad \begin{matrix} i = 1,2,\ldots,p \\ m = 1,2,\ldots,t \end{matrix}$$

Group standard deviations

$$s_{mi} = \frac{1}{n_m - 1} \sum_{k=1}^{n_m} (x_{mki} - \bar{x}_{mi})^2 \qquad \begin{matrix} i = 1,2,\ldots,p \\ m = 1,2,\ldots,t \end{matrix}$$

Within and total cross-product matrices

$$W = \{w_{ij}\};\ w_{ij} = \sum_{m=1}^{g} \sum_{k=1}^{n_m} (x_{mki} - \bar{x}_{mi})(x_{mkj} - \bar{x}_{mj})$$

$$T = \{t_{ij}\};\ t_{ij} = \sum_{m=1}^{g} \sum_{k=1}^{n_m} (x_{mki} - \bar{x}_{i})(x_{mkj} - \bar{x}_{j})$$

$$\begin{matrix} i = 1,2,\ldots,p \\ j = 1,2,\ldots,p \end{matrix}$$

Within groups covariance matrix

$$V = \{v_{ij}\};\ v_{ij} = \frac{1}{n-g} w_{ij} \qquad \begin{matrix} i = 1,2,\ldots,p \\ j = 1,2,\ldots,p \end{matrix}$$

Within groups correlation matrix

$$R = \{r_{ij}\};\ r_{ij} = \frac{w_{ij}}{\sqrt{w_{ii} w_{jj}}} \qquad \begin{matrix} i = 1,2,\ldots,p \\ j = 1,2,\ldots,p \end{matrix}$$

Step 2: At each step of the procedure the variables are divided into two disjoint sets; those included in the discriminant functions and those not included. Assume for simplicity that the first r are included.

Let $W = \begin{bmatrix} W_{11} & W_{12} \\ W_{21} & W_{22} \end{bmatrix}$ and $T = \begin{bmatrix} T_{11} & T_{12} \\ T_{21} & T_{22} \end{bmatrix}$

where W_{11} and T_{11} are r x r.

Let $A = \begin{bmatrix} W_{11}^{-1} & W_{11}^{-1} W_{12} \\ W_{21} W_{11}^{-1} & W_{22} - W_{21} W_{11}^{-1} W_{12} \end{bmatrix} = \{a_{ij}\}$

and

$$B = \begin{bmatrix} T_{11}^{-1} & T_{11}^{-1} T_{12} \\ T_{21} T_{11}^{-1} & T_{22} - T_{21} T_{11}^{-1} T_{12} \end{bmatrix} = \{b_{ij}\}$$

The following statistics are computed:

a) Coefficients and constant terms of the classification functions

$$c_{ki} = (n-g) \sum_{j=1}^{r} \bar{x}_{kj} a_{ij} \qquad \begin{matrix} i = 1,2,\ldots,r \\ k = 1,2,\ldots,g \end{matrix}$$

$$c_{k0} = \frac{1}{2} \sum_{i=1}^{r} c_{ki} \bar{x}_{ki} \qquad k = 1,2,\ldots,g$$

b) The square of the Mahalanobis distance between each pair of groups

$$D_{m\ell} = \sum_{i=1}^{r} (c_{mi}-c_{\ell i})(\bar{x}_{mi}-\bar{x}_{\ell i}) \qquad m,\ell = 1,\ldots,g$$

c) The F values for testing differences between each pair of groups

$$F_{m\ell} = \frac{(n-g-r+1)n_m n_\ell}{r(n-g)(n_m+n_\ell)} \; D_{m\ell} \qquad m,\ell = 1,\ldots,g$$

with r and n-g-r+1 degrees of freedom.

d) F values for each variable

(1) If variable j has been entered

$$F_j = \frac{a_{jj}-b_{jj}}{b_{jj}} \; \frac{n-r-g+1}{g-1}$$

with degrees of freedom g-1 and n-r-g+1

(2) If variable j has not been entered

$$F_j = \frac{b_{jj}-a_{jj}}{a_{jj}} \; \frac{n-r-g}{g-1}$$

with degrees of freedom g-1 and n-g-r

Under the usual normality assumptions these are the likelihood ratio tests of the equality over all g groups of the conditional distribution of variable j given the (remaining) entered variables.

e) U statistic to test equality of group means

$$U = \text{Det}(W_{11})/\text{Det}(T_{11})$$

with degrees of freedom (r,g-1,n-g)

f) Approximate F statistic to test equality of group means

$$F = \frac{1-U^{1/s}}{U^{1/s}} \cdot \frac{ms+1-rq/2}{rq}$$

where

$$s = \sqrt{\frac{r^2q^2-4}{r^2+q^2-5}}, \text{ if } r^2+q^2 \neq 5$$

$$s = 1, \text{ if } r^2+q^2 = 5$$

$$m = n - \frac{r+q+3}{2}$$

$$q = g-1$$

its degrees of freedom are rq and ms+1-rq/2. If either r or q is 1 or 2, the approximation is exact.

g) Tolerance values

$$w_i = a_{ii}/t_{ii}, \qquad i = r+1,\ldots,p$$

A variable passes the tolerance test if and only if w_i and t_i equal or exceed the value specified.

Step 3: To move from one step to the next, one variable is added or removed from the discriminating set according to one of the following rules:

a) If there are one or more variables which are entered, have a control value of 1 and an F value less than "F to remove," the one with the smallest F will be deleted.

b) If no variable satisfies a), then from among those variables which have not been included, which pass the tolerance test, and have greatest control value, the variable selected has greatest F-to-enter.

Step 4: After the last step the following are computed for $\ell = 1,2,\ldots,t$; $m = 1,2,\ldots,g$; $k = 1,2,\ldots,n_\ell$:

a) Value of the m^{th} classification function evaluated at case k of group ℓ

$$s_{\ell mk} = c_{mo} + \sum_{j=1}^{r} c_{mj} x_{\ell kj}$$

b) Posterior probability of case k in group ℓ having come from group m

$$P_{\ell mk} = \frac{\text{Exp}(s_{\ell mk})}{\sum_{i=1}^{g} \text{Exp}(s_{\ell il})}$$

c) Square of Mahalanobis distance of case k in group m from group ℓ

$$D^2_{\ell mk} = (n-g) \sum_{i=1}^{r} \sum_{j=1}^{r} (x_{mki} - \bar{x}_{\ell i}) a_{ij} (x_{mkj} - \bar{x}_{\ell j})$$

This may be used as a chi-square variable with r degrees of freedom for classification purposes.

Step 5: At this point let p denote the number of variables which are included after the last step and let W and T be their within and total sum of product matrices. Let B = T-W. The eigenvalue problem

$$Bu_i = \lambda_i W u_i \qquad i = 1,2,\ldots,p$$

is solved to find coefficients, u_i of canonical variables and the amount of dispersion λ_i explained by each canonical variable.

The vectors are normalized so that

$$u_i' W u_j = \delta_{ij}$$

The canonical correlations $\rho_1, \rho_2, \ldots, \rho_p$ relative to the groups are then computed

$$\rho_i = (\lambda_i/(1+\lambda_i))^{1/2}$$

For each case the first three canonical variables are computed

$$z_{mki} = \sum_{j=1}^{r} u_{ji}(x_{mkj}-\bar{x}_j) \qquad \begin{array}{l} m = 1,\ldots,g \\ k = 1,2,\ldots,n_m \\ i = 1,2,2 \end{array}$$

The first two of these are plotted on a scattergram. If called for it is stratified onto g separate plots on the basis of the value of z_{mk3}. The cutpoints used are the average of adjacent values,

after ordering, of $\bar{z}_{m3} = \frac{1}{n_m} \sum_{k=1}^{n_m} z_{mk3}$.

APPENDIX B

Variables: Operational Definitions and Crosstabulations by Smoker Categories

Education (X_1)

Question 179. How many years of formal education have you completed?

Number of years completed	Smoker Categories					
	Nosmkr	Succes	Unsucces	Noatt	No.	%
3	1	0	0	0	1	.3
4	1	0	1	0	2	.6
5	1	1	0	0	2	.6
6	1	0	0	0	1	.3
7	0	8	2	1	11	3.4
8	29	19	8	7	63	19.2
9	3	3	7	0	13	4.0
10	2	2	3	5	12	3.7
11	6	3	4	1	14	4.3
12	46	35	35	23	139	42.4
13	11	3	5	1	20	6.1
14	8	2	5	3	18	5.5
15	6	0	6	1	13	4.0
16	4	4	2	3	13	4.0
17	0	0	2	0	2	.6
18	0	1	1	0	2	.6
21	1	1	0	0	2	.6
Total	120	82	81	45	328	100.0

Age (X_2)

Question 180. What is your birth date?

Number of years old	Smoker Categories					
	Nosmkr	Succes	Unsucces	Noatt	No.	%
21-25	5	4	8	7	24	7.3
26-35	24	12	27	9	72	22.0
36-45	15	20	10	8	53	16.2
46-55	26	11	18	10	65	19.8
56-65	17	14	12	6	49	14.9
66-75	25	16	3	4	48	14.6
Over 75	8	5	3	1	17	5.2
Total	120	82	81	45	328	100.0

Number of People in Household (X_3)

Question 181. How many people are living in this household, including yourself, who are: 5 years and under, 6 through 12 years, 13 through 16 years, 17 through 20 years, 21 years old and over?

Number of people in household	Smoker Categories					
	Nosmkr	Succes	Unsucces	Noatt	No.	%
1	12	9	4	4	29	8.8
2	48	29	25	17	119	36.3
3	14	12	13	10	49	14.9
4	23	13	19	5	60	18.3
5	9	9	12	3	33	10.1
6	8	5	7	4	24	7.3
7	4	4	1	1	10	3.0
8	1	0	0	1	2	.6
9	1	1	0	0	2	.6
Total	120	82	81	45	328	100.0

Insurance (X_4)

Question 184. Do you have any type of life insurance?
Question 185. Do you have any type of health insurance?

Respondent has health and/or life insurance	Smoker Categories					
	Nosmkr	Succes	Unsucces	Noatt	No.	%
Has neither life or health ins.	13	6	4	3	26	7.9
Has either life or health ins.	33	18	23	11	85	25.9
Has both life and health ins.	74	58	54	31	217	66.2
Total	120	82	81	45	328	100.0

Perceived Concern (X_5) (Index constructed by summing the levels of perceived concern for the repeated questions)

Question 192. On the average, how concerned do you find the people in this community are about the effects of cigarette smoking on health?

Question 193. On the average, how concerned do you think the general public is about the effects of cigarette smoking on public health?

Question 194. On the average, how concerned do you think the members of this household are about the effects of cigarette smoking on health?

Question 195. On the average, how concerned do you think the majority of your friends are about the effects of cigarette smoking on health?

Perceived concern level		Smoker Categories					
		Nosmkr	Succes	Unsucces	Noatt	No.	%
No concern	4	0	1	2	2	5	11.5
	6	1	0	1	1	3	.9
	7	1	0	1	1	3	.9
Almost no concern	8	3	4	2	3	12	3.7
	9	4	1	5	1	11	3.4
	10	5	2	5	1	13	4.0
	11	5	6	6	2	19	5.8
A little concern	12	21	14	21	18	74	22.6
	13	22	8	14	7	51	15.5
	14	22	14	6	4	46	14.0
	15	12	14	2	0	28	8.5
Much concern	16	10	6	11	3	30	9.1
	17	11	4	4	1	20	6.1
	18	3	3	0	0	6	1.8
	19	0	2	1	0	3	.9
Very much concern	20	0	3	0	1	4	1.2
	Total	120	82	81	45	328	100.0

Major Health Problems (X_6)

Question 1b,c. I would like you to think just about the state of Iowa and indicate the degree to which you feel that each of these problems needs immediate attention and action. (Index constructed by summing the level of attention needed for the respective problems)

1b. Cancer

1c. Respiratory diseases (Bronchitis, etc.)

Degree of attention	Smoker Categories					
	Nosmkr	Succes.	Unsucces.	Noatt.	No.	%
Needs no immediate and no future attention	1	2	1	0	1	1.2
	0	1	0	0	1	.3
Needs no immediate and little future attention	1	0	0	0	1	.3
	11	1	3	0	5	1.5
Needs no immediate attention but some future attention	4	1	6	1	12	3.7
	3	10	5	2	20	6.1
Needs some immediate attention	18	14	8	9	49	14.9
	46	24	22	17	109	33.2
Needs much immediate attention	46	29	36	16	127	38.7
Total	120	82	81	45	328	100.0

Cause of Health Problems (X_7)

Question 4c. I would like to have you think just about the state of Iowa and indicate the degree to which you feel that cigarette smoking as a cause of health problems needs immediate attention.

Degree of attention	Smoker Categories					
	Nosmkr	Succes	Unsucces	Noatt	No.	%
Needs no immediate attention and no future attention	3	7	7	4	21	6.4
Needs no immediate attention and little future attention	6	1	1	2	10	3.0
Needs no immediate attention and some future attention	3	5	9	3	20	6.1
Needs some immediate attention	44	27	33	19	123	37.5
Needs much immediate attention	64	42	31	17	154	47.0
Total	120	82	81	45	328	100.0

Aware Smokers Should Stop (X_8)

Question 34. Have you ever seen or heard anything that has specifically suggested that smokers stop smoking cigarettes?

Aware smokers should stop	Smoker Categories					
	Nosmkr	Succes	Unsucces	Noatt	No.	%
No	25	16	17	15	73	22.3
Yes	95	66	64	30	255	77.7
Total	120	82	81	45	328	100.0

Think Smokers Should Stop (X_9)

Question 53. Do you think that cigarette smokers should stop smoking cigarettes?

Think smokers should stop	Smoker Categories					
	Nosmkr	Succes	Unsucces	Noatt	No.	%
Certainly should not stop smoking cigarettes	3	3	2	2	10	3.0
Probably should not stop smoking cigarettes	0	1	4	1	6	1.8
Maybe should, maybe should not stop smoking cigarettes	10	14	24	15	63	19.2
Probably should stop smoking cigarettes	19	14	26	17	76	23.2
Certainly should stop smoking cigarettes	88	50	25	10	173	52.7
Total	120	82	81	45	328	100.0

Change of Acceptance in Community (X_{10})

Question 57. Have you noticed any change in the last two years in the acceptance of cigarette smoking in this community?

Change of acceptance	Smoker Categories					
	Nosmkr	Succes	Unsucces	Noatt	No.	%
There is less acceptance of cigarette smoking in this community	43	41	28	12	124	37.8
There is no change of acceptance of cigarette smoking in this community	69	33	49	29	180	54.9
There is greater acceptance of cigarette smoking in this community	8	8	4	4	24	7.3
Total	120	82	81	45	328	100.0

Situation Facilitates Smoking (X_{11})

Question 59. Are there places in this community where cigarette smokers are made to feel uneasy as they smoke?

Question 61. Is cigarette smoking permitted where you work?

Question 63. Are there persons in this community who are openly opposed to smoking?

Question 68. Are there organizations in this community which are openly opposed to cigarette smoking?

Question 72. Does your closest friend at work smoke?

Question 73. Are there those where you work who are openly opposed to people smoking?

Question 77. Does your closest friend, other than those with whom you work, smoke cigarettes?

Question 78. Are there persons with whom you associate and consider your friends, other than those at work, who are openly opposed to cigarette smoking?

Question 83. Are there persons in this household, including yourself, who are openly opposed to smoking?

(Index constructed by summing the number of YES responses to questions 59, 63, 68, 73, 78 and 83 and the number of NO responses to questions 61, 72, and 77 for each respondent)

Support for stopping cigarette smoking	Smoker Categories					
	Nosmkr	Succes	Unsucces	Noatt	No.	%
No support for stopping	12	8	20	9	49	14.9
	27	19	20	14	80	24.4
	26	19	15	12	72	22.0
	30	15	11	3	59	18.0
Moderate support for smoking	10	6	8	4	28	8.5
	10	6	6	3	25	7.6
	4	7	0	0	11	3.4
	0	1	1	0	2	.6
High support for stopping	1	1	0	0	2	.6
Total	120	82	81	45	328	100.0

Change of Acceptance in General (X_{12})

Question. Have you noticed any change in the last two years in the acceptance of cigarette smoking generally?

Change of acceptance	Smoker Categories					
	Nosmkr	Succes	Unsucces	Noatt	No.	%
There is less acceptance of cigarette smoking generally	48	43	31	15	137	41.8
THere is no change in acceptance of cigarette smoking generally	60	32	46	25	163	49.7
There is greater acceptance of cigarette smoking generally	12	7	4	5	28	8.5
Total	120	82	81	45	328	100.0

Sampling Strata (X_{13})

Sampling strata	Smoker Categories					
	Nosmkr	Succes	Unsucces	Noatt	No.	%
Open country	64	38	34	16	152	46.3
Rural Place	30	21	29	14	94	28.7
2,500-4,999	12	8	6	9	35	10.7
5,000-9,999	9	8	7	3	27	8.2
10,000-25,000	5	7	5	3	20	6.1
Total	120	82	81	45	328	100.0

Decision at Present (X_{15})

Questions 153, 165. Which of the alternatives best represents what you have decided to do about your cigarette smoking at the present time?

Alternatives	Smoker Categories					
	Nosmkr	Succes	Unsucces	Noatt	No.	%
Try to quit	0	0	9	1	10	3.0
Try to cut down and quit later	0	0	13	5	18	5.5
Try to cut down	0	0	13	5	18	5.5
Undecided	0	0	10	8	18	5.5
No change now	0	0	36	26	62	18.9
Does not apply, nonsmoker	120	0	0	0	120	36.6
Does not apply, stopped smoking	0	82	0	0	82	25.0
Total	120	82	81	45	328	100.0

Alternative Like to Use (X_{14})

Questions 152, 164. Aside from what you think you actually could do, which of the alternatives best represents what you would most like to do about the number of cigarettes you smoke?

Alternatives	Smoker Categories					
	Nosmkr	Succes	Unsucces	Noatt	No.	%
Quit	0	0	21	7	28	8.5
Cut down and quit later	0	0	15	7	22	6.7
Cut down	0	0	15	7	22	6.7
Undecided	0	0	9	7	16	14.9
No change now	0	0	21	17	38	11.6
Does not apply nonsmoker	120	0	0	0	120	36.6
Does not apply stopped smoking	0	82	0	0	82	25.0
Total	120	82	81	45	328	100.0

Status of Head of Household (X_{16})

Question 174, 178. What is your (your husbands) occupation? (Data were coded using North-Hatt Scale and additions to North-Hatt Scale)

Status Ranking	Smoker Categories					
	Nonsmoker	Succes	Unsucces	Noatt	No.	%
00	8	0	1	1	10	3.0
40	0	1	0	0	1	.3
44	0	0	0	3	3	.9
45	0	2	0	0	2	.6
47	0	0	1	0	1	.3
48	1	1	0	1	3	.9
49	1	0	0	0	1	.3
50	1	3	1	3	8	2.4
51	0	2	0	0	2	.6
52	0	0	1	0	1	.3
54	2	3	5	1	11	33.4
55	4	0	3	1	8	2.4
57	0	0	1	0	1	.3
58	1	1	0	0	2	.6
59	2	2	2	4	10	3.0
60	4	3	5	0	10	3.0
62	4	3	5	0	12	3.7
63	1	0	0	1	2	.6
64	0	2	0	0	2	.6
65	5	6	8	4	23	.7
66	2	6	3	0	11	3.4
67	3	1	3	3	10	3.0
68	9	5	10	3	27	8.2
69	1	2	0	1	4	1.2
70	6	5	4	2	17	5.2
71	0	0	0	1	1	.3
72	2	2	0	1	5	1.5
73	1	0	0	0	1	.3
74	2	0	0	0	2	.6
75	1	0	0	0	1	.3
76	57	28	21	13	119	36.3
77	1	0	0	0	1	.3
78	2	1	6	0	9	2.7
79	0	1	1	2	4	1.2
80	1	1	1	0	3	.9
81	0	2	0	0	2	.6
82	1	0	0	0	1	.3
86	0	0	1	0	1	.3
89	0	0	2	0	2	.6
Total	120	82	81	45	328	100.0

Total Number of Organizations a Member of (X_{17})

Question 7. Are you presently a member of _____? (The total number of organizations that the respondent was a member of was summed)

No. of organizations	Smoker Categories					
	Nosmkr	Succes	Unsucces	Noatt	No.	%
None						
1	3	5	7	5	20	6.1
2	15	11	14	7	47	14.3
3	24	19	19	13	75	22.9
4	20	15	10	3	48	14.6
5	16	4	8	2	30	9.1
6	6	4	2	1	13	4.0
7	5	4	3	2	14	4.3
8	4	0	2	0	6	1.8
9	0	0	0	1	1	.3
10	2	0	3	0	5	1.5
12	1	0	1	1	3	.9
14	0	1	0	0	1	.3
17	0	1	0	0	1	.3
Total	120	82	81	45	327	100.0

Attitude-Restriction on Sales and Advertising (X_{18})

Attitude	Smoker Categories					
	Nosmkr	Succes	Unsucces	Noatt	No.	%
Do not support more restrictions						
12-20	0	1	0	3	4	1.2
21-30	1	0	10	2	13	3.9
31-40	2	5	9	4	20	6.1
41-50	4	4	14	9	31	9.4
51-60	17	10	22	8	57	17.4
61-70	18	20	14	11	63	19.2
71-80	23	12	6	4	45	13.7
81-90	20	13	1	1	35	10.7
91-100	17	6	0	2	25	7.6
Support more 101-112	18	11	5	1	35	10.7
Total	120	82	81	45	328	100.0

Attitude-Smoking and Health (X_{19})

Attitude	Smoker Categories: Nosmkr	Succes	Unsucces	Noatt	No.	%
Not variable toward smoking and continuing smoking						
0-10	17	7	1	2	27	278.2
11-20	18	15	5	2	40	12.2
21-30	16	13	5	2	36	10.9
31-40	21	8	15	3	47	14.3
41-50	12	12	10	2	36	10.9
51-60	11	7	7	6	31	9.4
61-70	6	5	9	5	25	7.6
71-80	4	6	8	8	26	7.9
81-90	10	4	7	2	23	7.0
91-100	3	0	5	4	12	3.6
101-110	1	0	2	5	8	2.4
111-120	1	2	4	0	7	2.1
121-130	0	1	1	1	3	0.9
131-140	0	1	0	1	2	0.6
Favorable toward smoking and continuing smoking						
141-148	0	1	1	2	4	1.2
Total	120	82	81	45	328	100.0

Attitude-Behavior of Exemplars (X_{20})

Attitude	Smoker Categories: Nosmkr	Succes	Unsucces	Noatt	No.	%
Do not support exemplars as role models						
0-10	1	1	1	2	5	1.5
11-20	0	1	3	3	7	2.1
21-30	0	0	7	4	11	3.3
31-40	4	3	10	5	22	6.7
41-50	1	7	11	9	28	8.5
51-60	10	9	13	4	36	10.9
61-70	43	19	13	7	82	25.0
Supports exemplars as role models						
71-80	61	42	23	11	137	41.7
Total	120	82	81	45	328	100.0

Attitude-Information on Smoking and Health (X_{21})

Attitude	Smoker Categories					
	Nosmkr	Succes	Unsucces	Noatt	No.	%
Do not support providing information on stopping smoking						
0-10	0	1	2	1	4	1.2
11-20	1	2	1	1	5	1.5
21-30	7	3	2	4	16	4.8
31-40	18	17	20	11	66	20.1
41-50	30	18	30	11	89	27.1
51-60	31	25	15	12	83	25.3
Supports providing information on stopping smoking						
61-64	33	16	11	5	65	19.8
Total	120	82	81	45	328	100.0

Beliefs (X_{22})

Belief	Smoker Categories					
	Nosmkr	Succes	Unsucces	Noatt	No.	%
Smoking not harmful to health						
0-10	2	0	0	0	2	.6
11-20	0	2	3	2	7	2.1
21-30	24	14	23	18	79	24.1
31-40	86	54	50	25	215	65.5
Smoking harmful to health						
41-45	8	12	5	0	25	7.6
Total	120	82	81	45	328	100.0

Situation (X_{23})

Situation	Smoker Categories Nosmkr	Succes	Unsucces	Noatt	No.	%
Situation does not facilitate stopping						
0	0	0	34	15	49	14.9
1	0	0	21	23	44	13.4
2	0	0	11	3	14	4.3
3	0	0	14	4	18	5.4
Situation facilitates stopping						
4	0	0	1	0	1	.3
Does not apply nonsmoker	120	0	0	0	120	36.6
Does not apply stopped smoking	0	82	0	0	82	25.0
Total	120	82	81	45	328	100.0

Number Smoked Heaviest (X_{24})

Question 95. On the average, how many cigarettes a day did you smoke during the period of your life when you were smoking the heaviest?

Number smoked per day	Smoker Categories Nosmkr	Succes	Unsucces	Noatt	No.	%
1 through 10	0	0	7	7	14	4.3
11 through 19	0	0	5	7	12	3.7
20 through 29	0	0	31	14	45	13.7
30 through 39	0	0	14	8	22	6.7
40 or more	0	0	24	9	33	10.1
Does not apply, nonsmoker	120					
Does not apply, category not used		82				
Total	120	82	81	45	328	100.0

Number Smoked at Present (X_{25})

Question 99. On the average, how many cigarettes do you now smoke each day?

Number smoked per day	Smoker Categories					
	Nosmkr	Succes	Unsucces	Noatt	No.	%
1 through 10	0	0	9	9	18	5.5
11 through 19	0	0	20	14	34	10.4
20 through 29	0	0	41	16	57	17.4
30 through 39	0	0	6	4	10	3.0
40 or more	0	0	5	2	7	2.1
Does not apply, nonsmoker	120	0				
Does not apply, stopped smoking	0	82				
Total	120	82	81	45	328	100.0

APPENDIX C

Social Psychological Scales and Reliability Coefficient Calculations

Attitude-Restriction on Sales and Advertising (X_{18})

Many statements concerning government involvement and restrictions on cigarette sales and advertising have been made about which people have different opinions. We would like your opinion on several of these statements. I'll read the statements and for each you can tell me whether you AGREE or DISAGREE.

After you have stated that you agree or disagree you can tell me how STRONGLY you feel that way. The numbers 1 through 5 are meant to indicate how strongly you feel about your agreement or disagreement with the statement. Indicate number 5 if you feel VERY STRONGLY about your agreement or disagreement to the statement. Indicate number 1 if you agree or disagree with the statement ONLY SLIGHTLY. For some statements, the number 2, 3, or 4 may better indicate how strongly you feel about your agreement or disagreement. (FOR EACH STATEMENT CIRCLE A FOR AGREE, D FOR DISAGREE, AND BOTH A AND D FOR A NO OPINION RESPONSE - ALSO CIRCLE THE NUMERAL INDICATING THE STRENGTH OF AGREEMENT OR DISAGREEMENT)

A.[1]	Sales of cigarettes to people under a certain age should be against the law.	A D 1 2 3 4 5
B.[1]	Selling cigarettes through cigarette machines should be against the law.	A D 1 2 3 4 5
C.[1]	The selling of cigarettes should be stopped immediately.	A D 1 2 3 4 5
D.[1]	Taxes on cigarettes should not be much higher than they are now.	A D 1 2 3 4 5
E.[1]	The smoking of cigarettes should be allowed in fewer places than it is now.	A D 1 2 3 4 5
F.[1]	Nothing should be done about cigarettes until the cigarette manufacturers are given a reasonable amount of time to come up with a safer cigarette.	A D 1 2 3 4 5
G.[1]	The advertising of cigarettes should not be controlled or limited.	A D 1 2 3 4 5

[1]Indicates items included in scale used in analyses.

Reliability Coefficient Calculations

Attitude-Restriction on Sales and Advertising (X_{18})

	A	B	C	D	E	F	G
A	1.0000						
B	0.3819	1.0000					
C	0.1850	0.3573	1.0000				
D	0.0466	0.1393	0.2648	1.0000			
E	0.1951	0.3287	0.5099	0.2431	1.0000		
F	0.0629	0.0849	0.2559	0.2892	0.2000	1.000	
G	0.0800	0.2054	0.3510	0.1689	0.2942	0.2573	1.0000
r_{it}	0.3930	0.5855	0.7188	0.5611	0.6855	0.5420	0.5945

$1/\sqrt{n} = 1/\sqrt{7} = 1/2.6458 = 0.3780$

$r_{it} > 1/\sqrt{n} = X_A .\underline{3930}\ \ X_B .\underline{5855}\ \ X_C .\underline{7188}\ \ X_D .\underline{5611}\ \ X_E .\underline{6855}$

$X_F .\underline{5420}\ \ X_G .\underline{5945}$

$\bar{r} = \sum_{i=1}^{n'} ri\ /n'$ where n' = number of r_{ii} representing the variables with $r_{it} > 1/\sqrt{n}$

$\bar{r} = \frac{4.9014}{21} = 0.2334$

$r_{tt} = \frac{n\bar{r}}{1+(n-1)\bar{r}} = \frac{(7)\ (.2334)}{1+(6)\ (.2334)} = \frac{1.6338}{2.4004} = 0.6806$

Attitude - Smoking and Health (X_{19})

Many statements concerning smoking and health have been made about which people have different opinions. We would like your opinion on several of these statements. I'll read the statements and you can tell me whether you AGREE or DISAGREE with the statement and how strongly you feel about your agreement or disagreement. Use the numbers 1 through 5 to indicate the strength of your agreement or disagreement. Use number 1 to indicate SLIGHT AGREEMENT or DISAGREEMENT and number 5 to indicate STRONG AGREEMENT or DISAGREEMENT. For some statements the numbers 2, 3, or 4 may better represent the strength of your feelings.

A.[1]	Cigarette smoking is not harmful to a smoker's health as long as a person smokes moderately.	A 1 2 3 4 5 D
B.[1]	People have enough problems without adding to them by trying to give up smoking cigarettes.	A 1 2 3 4 5 D
C.[1]	If a person has already smoked for years, it is too late for stopping smoking to do him much good.	A 1 2 3 4 5 D
D.[1]	A person has to die from something, so it might as well be cigarettes.	A 1 2 3 4 5 D
E.[1]	Most cigarette smokers can stop if they want to.	A 1 2 3 4 5 D
F.[1]	Being afraid of gaining a lot of weight keeps people from quitting smoking.	A 1 2 3 4 5 D
G.[1]	The whole problem of cigarette smoking and health is a very minor one.	A 1 2 3 4 5 D
H.[1]	Cigarette smoking can't be a cause of lung cancer because some people who had lung cancer never smoked.	A 1 2 3 4 5 D
I.[1]	The connection between smoking and disease is not yet proved because it is only based on statistics.	A 1 2 3 4 5 D

[1]Indicates items included in scale used in final analyses.

J.[1] Most people will not even try to give up smoking unless their doctor tells them to. A 1 2 3 4 5 D

K.[1] The chances of getting lung cancer from smoking cigarettes are so small that it's foolish to worry about it. A 1 2 3 4 5 D

L.[1] A cigarette smoker can always quit later in life in plenty of time to avoid any bad effects. A 1 2 3 4 5 D

M.[1] Clinics to learn how to give up smoking should be set up to help those who want to quit but haven't been able to do it by themselves. A 1 2 3 4 5 D

[1]Indicates items included in scale used in final analyses.

Reliability Coefficient Calculations

Attitude - Smoking and Health (X_{19})

	A	B	C	D	E	F	G
A	1.0000						
B	0.3649	1.0000					
C	0.2712	0.3963	1.0000				
D	0.2507	0.3059	0.3332	1.0000			
E	0.0999	0.2710	0.2208	0.1138	1.0000		
F	0.0070	0.0513	0.0424	-0.0198	-0.0398	1.0000	
G	0.4301	0.3094	0.2747	0.2994	0.0674	-0.0610	1.0000
H	0.3695	0.3527	0.3779	0.3194	0.0554	-0.0368	0.4318
I	0.3877	0.3183	0.2744	0.3527	0.0762	0.0495	0.3879
J	0.0165	-0.0025	0.0747	-0.0427	-0.0836	0.0898	0.0199
K	0.3987	0.2707	0.3346	0.4333	0.0582	-0.0081	0.4803
L	0.3740	0.2554	0.3091	0.3413	-0.0084	-0.0707	0.4326
M	0.1037	0.9667	0.1431	0.1930	0.0224	-0.1998	0.2008
r_{it}	0.6141	0.6097	0.6107	0.5829	0.2937	0.1367	0.6351

	H	I	J	K	L	M
H	1.0000					
I	0.4808	1.0000				
J	0.0742	0.0606	1.0000			
K	0.4448	0.4537	0.0434	1.0000		
L	0.4245	0.2886	0.0752	0.5036	1.0000	
M	0.1166	0.1271	-0.0050	0.1873	0.1463	1.0000
r_{it}	0.6613	0.6520	0.2038	0.6545	0.5899	0.3395

$$1/\sqrt{n} = 1/\sqrt{13} = 0.2773$$

$$r_{it} > 1/\sqrt{n} = X_A\ .\underline{6141}\quad X_B\ .\underline{6097}\quad X_C\ .\underline{6107}\quad X_D\ .\underline{5829}\quad X_E\ .\underline{2937}$$
$$X_G\ .\underline{6351}\quad X_H\ .\underline{6613}\quad X_I\ .\underline{6520}\quad X_K\ .\underline{6545}\quad X_L\ .\underline{5899}$$
$$X_M\ .\underline{3395}$$

$\bar{r} = \sum_{i=1}^{n'} r_i/n'$ where n' = number of r_{ii} representing the variables with $r_{it} > 1/\sqrt{n}$

$$\bar{r} = \frac{15.2979}{55} = 0.2781$$

$$r_{tt} = \frac{n\bar{r}}{1+(n-1)\bar{r}} = \frac{(11)\ (.2781)}{1+(10)\ (.2781)} = \frac{3.0591}{3.7810} = 0.8091$$

Attitude - Behavior of Exemplars (X_{20})

Many statements concerning information on smoking and health, advertising about cigarettes, and the smoking behavior of certain persons have been made about which people have different opinions. We would like your opinion on several of these statements. Again, I'll read the statements and you can tell me whether you AGREE or DISAGREE with the statement and use the numbers from 1 through 5 to indicate how strongly you feel about your agreement or disagreement.

A.[1] Parents should set a good example by not smoking cigarettes. A 1 2 3 4 5 D

B.[1] Doctors should set a good example by not smoking cigarettes. A 1 2 3 4 5 D

C.[1] Teachers should set a good example by not smoking cigarettes. A 1 2 3 4 5 D

D.[1] If parents smoke they should allow their children to smoke. A 1 2 3 4 5 D

E.[1] People in the health professions should set a good example by not smoking. A 1 2 3 4 5 D

	A	B	C	D	E
A	1.0000				
B	0.6516	1.0000			
C	0.6132	0.7471	1.0000		
D	0.1403	0.1397	0.1511	1.0000	
E	0.6083	0.7126	0.7638	0.0669	1.0000
r_{it}	0.7823	0.8520	0.8609	0.4462	0.8197

$1/\sqrt{n} = 1/\sqrt{5} = 0.4472$

$r_{it} > 1/\sqrt{n} = X_A .\underline{7823}\ \ X_B .\underline{8520}\ \ X_C .\underline{8609}\ \ X_E .\underline{8197}$

$\bar{r} = \sum_{i=1}^{n'} r_{ri} / n'$ where n' - number of r_{ii} representing the variables with $r_{it} > 1/\sqrt{n}$

$\bar{r} = \frac{4.0966}{6} = 0.6828$

$r_{tt} = \frac{n\bar{r}}{1(n-1)\bar{r}} = \frac{(4)\ (.6828)}{1+(3)\ (.6828)} = \frac{2.7312}{3.0484} = 0.8959$

[1]Indicates items included in scale used in analyses.

Attitude - Information on Smoking and Health (X_{21})

Many statements concerning information on smoking and health, advertising about cigarettes, and the smoking behavior of certain persons have been made about which people have different opinions. We would like your opinion on several of these statements. Again, I'll read the statements and you can tell me whether you AGREE or DISAGREE with the statement and use the numbers from 1 through 5 to indicate how strongly you feel about your agreement or disagreement.

A.[1] Before people will be convinced that cigarette smoking is harmful to health, the government has to show that it is really worried about it. A 1 2 3 4 5 D

B.[1] Individual doctors should not be active in making speeches to the general public about the harmfulness of cigarette smoking. A 1 2 3 4 5 D

C.[1] There should be more education of the public about the health risk connected with smoking cigarettes. A 1 2 3 4 5 D

D.[1] There should be a special program of education education about cigarette smoking and health aimed at children in school. A 1 2 3 4 5 D

Reliability Coefficient Calculations

Attitude - Information on Smoking and Health (X_{21})

	A	B	C	D
A	1.0000			
B	0.1145	1.0000		
C	0.1662	0.2792	1.0000	
D	0.1757	0.1920	0.5492	1.0000
r_{it}	0.6102	0.6072	0.7301	0.6805

$1/\sqrt{n} = 1/\sqrt{4} = .5000$

$r_{it} > 1/\sqrt{n} = X_A .6102 \quad X_B . 6072 \quad X_C .7301 \quad X_D .6805$

[1]Indicates items included in scale used in analyses.

$$\bar{r} = \sum_{i=1}^{n'} r_i / n'$$

$$\bar{r} = \frac{1.4768}{6} = 0.2461$$

$$\bar{r} = \frac{n\bar{r}}{1(n-1)\bar{r}} = \frac{(4)\ (.2461)}{1+(3)\,(.2461)} = \frac{.9844}{1.7383} = 0.5663$$

Beliefs (X_{22})

In recent years a number of statements have been made about the relationship between smoking and health.

I'll read several of these statements and using the categories on CARD 8 you can tell me how much you AGREE or DISAGREE with each of them. (CIRCLE THE NUMERAL INDICATING THE DEGREE OF AGREEMENT OR DISAGREEMENT INDICATED BY THE RESPONDENT)

	STRONGLY AGREE	MILDLY AGREE	NO OPINION	MILDLY DISAGREE	STRONGLY DISAGREE
A.[1] Filters reduce the health risk in cigarette smoking	5	4	3	2	1
B.[1] Cigarette smoking causes chronic bronchitis	5	4	3	2	1
C.[1] Cigarette smoking is harmful to health	5	4	3	2	1
D.[1] Women who smoke during pregnancy are more likely to have premature babies than women who do not smoke during pregnancy	5	4	3	2	1
E.[1] If a person does not inhale them, cigarettes are harmless	5	4	3	2	1
F.[1] Mentholated cigarettes are safer than non-mentholated ones	5	4	3	2	1
G.[1] Cigarette smokers are more likely to die from heart disease than people who do not smoke	5	4	3	2	1

[1]Indicates items included in scale used in analyses.

		STRONGLY AGREE	MILDLY AGREE	NO OPINION	MILDLY DISAGREE	STRONGLY DISAGREE
H.[1]	Cigarette smoking shortens a person's life	5	4	3	2	1
I.[1]	The effects of cigar or pipe smoking on health are about the same as the effects of cigarette smoking on health	5	4	3	2	1

[1]Indicates items included in scale used in analyses.

Reliability Coefficient Calculations

Beliefs (X_{22})

	A	B	C	D	E	F	G	H	I
A	1.000								
B	0.057	1.000							
C	0.061	0.491	1.000						
D	0.055	0.426	0.352	1.000					
E	0.220	0.139	0.211	0.142	1.000				
F	0.348	0.140	0.138	0.150	0.332	1.000			
G	0.050	0.398	0.358	0.383	0.138	0.050	1.000		
H	0.026	0.526	0.498	0.380	0.247	0.123	0.642	1.000	
I	0.032	0.115	0.032	0.195	0.021	0.054	0.105	0.047	1.000
r_{it}	0.398	0.642	0.582	0.619	0.516	0.485	0.631	0.689	0.358	1.000

$1/\sqrt{n} = 1/\sqrt{9} = 1/3.0 = 0.333$

$r_{it} > 1/\sqrt{n} = X_A\ \underline{0.398}\quad X_B\ \underline{0.642}\quad X_C\ \underline{0.582}\quad X_D\ \underline{0.619}\quad X_E\ \underline{0.516}$

$X_F\ \underline{0.485}\quad X_G\ \underline{0.631}\quad X_H\ \underline{0.689}\quad X_I\ \underline{0.358}$

$\bar{r}\ \sum_{i=1}^{n'} r_{ri}\ /n'$ where n' = number of r_{ii} representing the variables with $r_{it} > 1/\sqrt{n}$

$$\bar{r} = \frac{7.682}{36} = 0.213$$

$$r_{tt} = \frac{n\bar{r}}{1+(n-1)\bar{r}} = \frac{(9)(.213)}{1+(8)(.213)} = \frac{1.917}{2.704} = .708$$

Situation (X_{23})

People have made a number of statements about their situations regarding smoking cigarettes. On CARD 34 are some of those statements.

I'll read several of these statements and for each you can tell me if it is true or mostly true or false or mostly false for your situation.

		TRUE OR MOSTLY TRUE	FALSE OR MOSTLY FALSE
A.[1]	I am the only cigarette smoker in my household.	2	1
B.[1]	The majority of the people I know best are cigarette smokers.	1	2
C.[1]	When I handle a package of cigarettes, I almost never notice the warning "Caution: Cigarette Smoking May be Hazardous To Your Health".	1	2
D.[1]	The majority of the people I am around most of the time are cigarette smokers.	1	2
E.	Most of the articles about cigarette smoking in newspapers or magazines say that smoking is harmful.	2	1
F.	I think that there are more people now who are concerned about the health aspect of smoking than there were a few years ago.	2	1
G.[1]	There is one person in particular shose smoking makes it harder for me to quit.	1	2

[1]Indicates items included in scale used in analyses.

		TRUE OR MOSTLY TRUE	FALSE OR MOSTLY FALSE
H.[1]	Current cigarette advertising leaves the impression that smoking is a healthy thing to do.	2	1

[1]Indicates items included in scale used in analyses.

Reliability Coefficient Calculations

Situation (X_{23})

	A	B	C	D	E	F	G	H
A	1.000							
B	0.150	1.000						
C	0.034	0.167	1.000					
D	0.244	0.655	0.140	1.000				
E	0.040	0.026	0.120	0.100	1.000			
F	0.049	0.036	0.091	0.120	0.097	1.000		
G	0.401	0.036	0.128	0.007	0.008	0.110	1.000	
H	0.048	0.006	0.134	0.074	0.028	0.010	0.068	1.000
r_{it}	0.553	0.606	0.435	0.636	0.244	0.073	0.351	0.396

$1/\sqrt{n} = 1/\sqrt{8} = 1/2.8284 = 0.3535$

$r_{it} > 1/\sqrt{n} = X_A\ \underline{0.553}\quad X_B\ \underline{0.606}\quad X_C\ \underline{0.435}\quad X_D\ \underline{0.636}$

$X_G\ \underline{0.351}\quad X_H\ \underline{0.396}$

$\bar{r} = \sum_{i=1}^{n'} r_i/n'$ where n' = number of r_{ii} representing the variables with $r_{it} > 1/\sqrt{n}$

$\bar{r} = \frac{1.830}{6} = 0.305$

$r_{tt} = \frac{n\bar{r}}{1(n-1)\bar{r}} = \frac{(6)\ (.305)}{1+(5)\ (.305)} = \frac{1.830}{2.525} = 0.7248$

APPENDIX D

Stepwise Multiple Discriminant Analysis: Computer Output - F Values

All Categories:

Stepwise Analysis - 21 Variables F to Enter = 2.63

STEP NUMBER 0

VARIABLES NOT INCLUDED AND F TO ENTER - DEGREES OF FREEDOM 3 324

1.	1.8371	7.	2.2022	13.	1.1520	21.	3.0450
2.	6.2848	8.	1.2537	16.	.6597	22.	5.9172
3.	.4704	9.	14.2035	17.	1.2548		
4.	.8656	10.	1.4288	18.	30.7305		
5.	6.1706	11.	4.3503	19.	16.6507		
6.	1.1592	12.	1.3626	20.	21.0542		

STEP NUMBER 1
VARIABLE ENTERED 18

VARIABLES INCLUDED AND F TO REMOVE - DEGREES OF FREEDOM 3 324

18 30.7405

VARIABLES NOT INCLUDED AND F TO ENTER - DEGREES OF FREEDOM 3 323

1.	.8533	7.	.4394	13.	.7882	22.	2.1608
2.	2.7221	8.	.9767	16.	.7023		
3.	.9132	9.	3.7087	17.	.6096		
4.	.7459	10.	1.1478	19.	3.7804		
5.	1.8319	11.	1.0656	20.	4.5341		
6.	1.3750	12.	1.2784	21.	.7909		

APPROXIMATE F 30.73055 DEGREE OF FREEDOM 3 324.00

F MATRIX-DEGREES OF FREEDOM 1 324

	Group		
	NOSMKR	SUCCES	UNSUCS
GROUP			
SUCCES	2.60639		
UNSUCS	68.89937	37.73596	
ATTNOT	41.07278	22.96063	.15572

STEP NUMBER 2
VARIABLE ENTERED 20

VARIABLES INCLUDED AND F TO REMOVE - DEGREES OF FREEDOM 3 323

18 12.9468 20 4.5341

VARIABLES NOT INCLUDED AND F TO ENTER - DEGREES OF FREEDOM 3 322

1.	.8750	7.	1.2724	13.	.8214
2.	2.7555	8.	.9089	16.	.6908
3.	1.1103	9.	2.3287	17.	.4643
4.	.6499	10.	1.0796	19.	2.2484
5.	1.3459	11.	.8878	21.	1.5403
6.	1.5210	12.	1.1679	22.	2.4845

APPROXIMATE F 16.90312 DEGREES OF FREEDOM 6 646.00

F MATRIX - DEGREES OF FREEDOM 2 323

	GROUP		
	NOSMKR	SUCCES	UNSUCS
GROUP			
SUCCES	1.50443		
UNSUCS	37.70693	20.42052	
ATTNOT	27.10821	15.75955	1.08421

STEP NUMBER 3
VARIABLE ENTERED 2

VARIABLES INCLUDED AND F TO REMOVE - DEGREES OF FREEDOM 3 322

2 2.7555 18 10.9065 20 4.5625

VARIABLES NOT INCLUDED AND F TO ENTER - DEGREES OF FREEDOM 3 321

1.	.7998	8.	.9540	16.	.6417
3.	.3627	9.	2.4193	17.	.4553
4.	.6411	10.	1.0697	19.	3.4709
5.	1.2915	11.	1.3131	21.	1.1199
6.	1.2879	12.	1.1504	22.	2.3996
7.	1.1640	13.	.8813		

APPROXIMATE F 12.11568 DEGREES OF FREEDOM 9 783.81

F MATRIX - DEGREES OF FREEDOM 3 322

	GROUP		
	NOSMKR	SUCCES	UNSUCS
GROUP			
SUCCES	.99999		
UNSUCS	27.49369	15.59089	
ATTNOT	19.35467	11.64206	.73469

STEP NUMBER 4
VARIABLE ENTERED 19

VARIABLES INCLUDED AND F TO REMOVE - DEGREES OF FREEDOM 3 321

2 3.9821 18 6.8900 19 3.4709 20 2.4356

VARIABLES NOT INCLUDED AND F TO ENTER - DEGREES OF FREEDOM 3 320

1.	.7280	8.	.4593	16.	.5191
3.	.3829	9.	1.6413	17.	.3075
4.	.6385	10.	.9664	21.	1.8224
5.	.9649	11.	1.0053	22.	3.5470
6.	1.8241	12.	1.0916		
7.	1.9546	13.	.9065		

APPROXIMATE F 9.98059 DEGREES OF FREEDOM 12 849.58

F MATRIX - DEGREES OF FREEDOM 4 321

	GROUP		
	NOSMKR	SUCCES	UNSUCS
SUCCES	.76709		
UNSUCS	20.86125	11.80087	
ATTNOT	17.32619	10.90813	1.89840

STEP NUMBER 5
VARIABLE ENTERED 22

VARIABLES INCLUDED AND F TO REMOVE - DEGREES OF FREEDOM 3 320

2 4.4069 18 7.6016 19 4.6263 20 3.0583 22 3.5470

VARIABLES NOT INCLUDED AND F TO ENTER - DEGREES OF FREEDOM 3 319

1.	.6970	8.	.3604	16.	.4731
3.	.3908	9.	1.8687	17.	.4048
4.	.5900	10.	.9696	21.	1.7958
5.	.8604	11.	.9873		
6.	1.9131	12.	.9435		
7.	1.8000	13.	1.0303		

APPROXIMATE F 8.73516 DEGREES OF FREEDOM 15 883.78

F MATRIX - DEGREES OF FREEDOM 5 320

	GROUP		
	NOSMKR	SUCCES	UNSUCS
GROUP			
SUCCES	1.99472		
UNSUCS	18.53208	9.44667	
ATTNOT	14.84154	8.70136	1.52686

F LEVEL INSUFFICIENT FOR FURTHER COMPUTATION

DISCRIMINANT FUNCTIONS:

	FUNCTION			
	NOSMKR	SUCCES	UNSUCS	ATTNOT
VARIABLE				
2	.01464	-.02148	-.28616	-.34707
16	.16393	.15297	.11723	.13865
17	.29511	.30427	.31055	.32767
18	.19524	.18535	.16696	.15775
20	1.38198	1.46429	1.47869	1.46838
CONSTANT	-42.07118	-43.58872	-40.01717	-41.31094

SMOKER CATEGORIES:

Stepwise Analysis - 21 Variables F to Enter = 3.04

STEP NUMBER 0

VARIABLES NOT INCLUDED AND F TO ENTER - DEGREES OF FREEDOM 2 205

1.	2.8368	7.	.6929	13.	.2600	21.	1.0485
2.	5.8272	8.	1.7302	16.	1.4122	22.	8.3585
3.	.4663	9.	6.5216	17.	.4899		
4.	.0165	10.	2.0467	18.	21.1487		
5.	6.8682	11.	5.1499	19.	11.8144		
6.	.9940	12.	1.8495	20.	11.8832		

STEP NUMBER 1
VARIABLE ENTERED 18

VARIABLES INCLUDED AND F TO REMOVE - DEGREES OF FREEDOM 2 205

18 21.1487

VARIABLES NOT INCLUDED AND F TO ENTER - DEGREES OF FREEDOM 2 204

1.	.8667	7.	.5311	13.	.3565	22.	1.7846
2.	3.3032	8.	1.3677	16.	1.2330		
3.	1.2359	9.	.8552	17.	.4051		
4.	.0658	10.	.9462	19.	4.0904		
5.	2.3607	11.	1.4240	20.	2.3763		
6.	1.4820	12.	1.3611	21.	1.2804		

APPROXIMATE F 21.14870 DEGREES OF FREEDOM 2 205.00

F MATRIX DEGREES OF FREEDOM 1 205

	GROUP	
	SUCCES	UNSUCS
GROUP		
UNSUCS	36.53691	
ATTNOT	22.23106	.15078

STEP NUMBER 2
VARIABLE ENTERED 19

VARIABLES INCLUDED AND F TO REMOVE - DEGREES OF FREEDOM 2 204

18 12.7532 19 4.0904

VARIABLES NOT INCLUDED AND F TO ENTER - DEGREES OF FREEDOM
2 203

1.	1.5525	7.	1.1053	13.	.4062
2.	4.6596	8.	.4604	16.	.8786
3.	1.2366	9.	.0998	17.	.3173
4.	.0571	10.	.3300	20.	1.2216
5.	1.1267	11.	.9020	21.	1.8695
6.	2.2959	12.	.6976	22.	.1532

APPROXIMATE F 12.25390 DEGREES OF FREEDOM 4 408.00

F MATRIX - DEGREES OF FREEDOM 2 204

	GROUP	
	SUCCES	UNSUCS
GROUP		
UNSUCS	18.29206	
ATTNOT	15.04095	2.99117

STEP NUMBER 3
VARIABLE ENTERED 2

ARIABLES INCLUDED AND F TO REMOVE - DEGREES OF FREEDOM 2 203

2 4.6596 18 8.8030 19 5.4533

VARIABLES NOT INCLUDED AND F TO ENTER - DEGREES OF
FREEDOM 2 202

1.	.2837	8.	.7547	16.	.8671
3.	.5046	9.	.0028	17.	.4686
4.	.3392	10.	.1693	20.	.6800
5.	.6373	11.	1.5534	21.	1.4214
6.	1.7923	12.	.2749	22.	.2477
7.	1.2189	13.	.3782		

APPROXIMATE F 9.84950 DEGREES OF FREEDOM 6 406.00

F MATRIX - DEGREES OF FREEDOM 3 203

	GROUP	
	SUCCES	UNSUCS
GROUP		
UNSUCS	14.87528	
ATTNOT	12.60812	2.03424

F LEVEL INSUFFICIENT FOR FURTHER COMPUTATION

DISCRIMINANT FUNCTIONS:

	FUNCTION		
	SUCCES	UNSUCS	ATTNOT
VARIABLE			
2	.85287	.56363	.51731
16	.25065	.21111	.22687
17	.11096	.11799	.13485
CONSTANT	-13.42308	-10.19280	-12.01464

CURRENT SMOKER CATEGORIES:

Stepwise Analysis - 25 Variables F to enter = 3.92

STEP NUMBER 0

VARIABLES NOT INCLUDED AND F TO ENTER - DEGREES OF FREEDOM 1 124

1.	.1827	7.	.0216	13.	.5592	19.	3.8769	25.	1.9623
2.	.0856	8.	2.3333	14.	3.2954	20.	.7353		
3.	.9212	9.	.4763	15.	4.6970	21.	.1522		
4.	.0020	10.	1.2767	16.	1.9344	22.	1.5417		
5.	1.1704	11.	.2346	17.	.7324	23.	.8842		
6.	.7815	12.	1.0116	18.	.1528	24.	3.1821		

STEP NUMBER 1
VARIABLE ENTERED 15

VARIABLES INCLUDED AND F TO REMOVE - DEGREES OF FREEDOM 1 124

15 4.6970

VARIABLES NOT INCLUDED AND F TO ENTER - DEGREES OF FREEDOM 1 123

1.	.0564	7.	.0659	13.	.2629	20.	.2108
2.	.0069	8.	1.7811	14.	.7606	21.	.0416
3.	.5314	9.	.0437	16.	1.7289	22.	.8953
4.	.1408	10.	.6936	17.	1.1717	23.	1.1196
5.	.3086	11.	.0000	18.	.2452	24.	2.1083
6.	1.5962	12.	.3810	19.	2.3952	25.	2.3656

APPROXIMATE F 4.69705 DEGREES OF FREEDOM 1 124.00

F MATRIX - DEGREES OF FREEDOM 1 124

	GROUP
	UNSUCS
GROUP	
ATTNOT	4.69705

F LEVEL INSUFFICIENT FOR FURTHER COMPUTATION

CURRENT SMOKERS BY SEX CATEGORIES:

Stepwise Analysis - 25 Variables F to Enter = 2.68

STEP NUMBER 0

VARIABLES NOT INCLUDED AND F TO ENTER - DEGREES OF FREEDOM 3 122

1.	1.6510	7.	.4253	13.	3.3686	19.	1.3717
2.	4.2015	8.	5.1377	14.	1.8965	20.	.7850
3.	2.3397	9.	.2713	15.	1.6574	21.	1.6796
4.	.6792	10.	1.6835	16.	2.3895	22.	.7018
5.	1.2108	11.	1.1338	17.	.5890	23.	1.9902
6.	.8507	12.	2.4343	18.	.4954	24.	3.7774
						25.	4.0930

STEP NUMBER 1
VARIABLE ENTERED 8

VARIABLES INCLUDED AND F TO REMOVE - DEGREES OF FREEDOM 3 122

8 5.1377

VARIABLES NOT INCLUDED AND F TO ENTER - DEGREES OF FREEDOM 3 121

1.	.4443	7.	.2510	14.	1.5331	20.	.7951
2.	2.2190	9.	.2562	15.	1.4065	21.	1.3208
3.	3.0670	10.	2.3227	16.	3.0014	22.	1.0248
4.	.4407	11.	.5509	17.	.3939	23.	2.0148
5.	1.0823	12.	2.6396	18.	.5558	24.	3.7421
6.	.8382	13.	3.1525	19.	1.5763	25.	3.9064

APPROXIMATE F 5.13768 DEGREES OF FREEDOM 3 122.00

F MATRIX - DEGREES OF FREEDOM 1 122

	GROUP		
GROUP	MALE UNSUCS	FEMALE UNSUCS	MALE ATTNOT
FEMALE UNSUCS	1.59337		
MALE ATTNOT	6.26033	11.93959	
FEMALE ATTNOT	2.07641	.13456	11.28176

STEP NUMBER 2
VARIABLE ENTERED 25

VARIABLES INCLUDED AND F TO REMOVE - DEGREES OF FREEDOM 3 121

8 4.9389 25 3.9064

VARIABLES NOT INCLUDED AND F TO ENTER - DEGREES OF FREEDOM
3 120

1.	.3998	7.	.0953	14.	1.4669	20.	.9713
2.	1.9899	9.	.2888	15.	1.5673	21.	1.3058
3.	300380	10.	2.1904	16.	2.4086	22.	1.2061
4.	.5548	11.	.5841	17.	.3580	23.	2.8744
5.	.9382	12.	2.5200	18.	.7493	24.	.8051
6.	.5004	13.	2.8396	19.	1.7914		

APPROXIMATE F 4.49705 DEGREES OF FREEDOM 6 24200

F MATRIX - DEGREES OF FREEDOM 2 121

	GROUP		
GROUP	MALE UNSUCS	FEMALE UNSUCS	MALE ATTNOT
FEMALE UNSUCS	5.36636		
MALE ATTNOT	5.22346	6.12437	
FEMALE ATTNOT	4.1131	.06791	5.72542

STEP NUMBER 3
VARIABLE ENTERED 3

VARIABLES INCLUDED AND F TO REMOVE - DEGREES OF FREEDOM 3 120

3 3.0380 8 5.6994 25 3.8704

VARIABLES NOT INCLUDED AND F TO ENTER - DEGREES OF FREEDOM
3 119

1.	.4980	9.	.1291	15.	1.5856	21.	1.4536
2.	3.7212	10.	2.3540	16.	2.4385	22.	1.1096
4.	.9524	11.	.5917	17.	.3305	23.	3.1441
5.	.9003	12.	2.5056	18.	1.0139	24.	.7520
6.	.4592	13.	2.5600	19.	1.6154		
7.	.0861	14.	1.5271	20.	1.0514		

APPROXIMATE F 4.02780 DEGREES OF FREEDOM 9 292.20

F MATRIX - DEGREES OF FREEDOM 3 120

	GROUP		
	MALE UNSUCS	FEMALE UNSUCS	MALE ATTNOT
GROUP			
FEMALE UNSUCS	4.02999		
MALE ATTNOT	4.17433	4.09366	
FEMALE ATTNOT	3.70931	2.31535	6.31986

STEP NUMBER 4
VARIABLE ENTERED 2

VARIABLES INCLUDED AND F TO REMOVE - DEGREES OF FREEDOM 3 119

2 3.7212 3 4.8041 8 3.3864 25 3.6120

VARIABLES NOT INCLUDED AND F TO ENTER - DEGREES OF FREEDOM 3 118

1.	.1989	10.	1.8444	16.	1.6916	22.	.6201
4.	.9495	11.	.4410	17.	.8077	23.	2.2936
5.	.9596	12.	1.7273	18.	.9937	24.	1.0858
6.	.3569	13.	2.8588	19.	1.9470		
7.	.1015	14.	1.4521	20.	.9288		
9.	.0611	15.	1.5825	21.	1.5225		

APPROXIMATE F 3.99073 DEGREES OF FREEDOM 12 315.14

F MATRIX - DEGREES OF FREEDOM 4 119

	GROUP		
	MALE UNSUCS	FEMALE UNSUCS	MALE ATTNOT
GROUP			
FEMALE UNSUCS	3.61104		
MALE ATTNOT	3.24984	4.11088	
FEMALE ATTNOT	4.82942	2.28169	7.26134

STEP NUMBER 5
VARIABLE ENTERED 13

VARIABLES INCLUDED AND F TO REMOVE - DEGREES OF FREEDOM 3 118

2 4.0190 3 4.4706 8 3.1521 13 2.8588 25 3.2913

VARIABLES NOT INCLUDED AND F TO ENTER - DEGREES OF FREEDOM 3 117

1.	.2110	10.	1.7014	17.	.7467	23.	1.6635
4.	1.0694	11.	.7283	18.	1.0262	24.	.7346
5.	.9416	12.	1.3762	19.	1.8680		
6.	.9473	14.	1.1977	20.	.9893		
7.	.0913	15.	1.5407	21.	1.5175		
9.	.0709	16.	1.2092	22.	.4534		

APPROXIMATE F 3.79817 DEGREES OF FREEDOM 15 326.15

F MATRIX - DEGREES OF FREEDOM 5 118

	GROUP		
	MALE UNSUCS	FEMALE UNSUCS	MALE ATTNOT
GROUP			
FEMALE UNSUCS	3.32933		
MALE ATTNOT	2.61080	3.83221	
FEMALE ATTNOT	5.38621	2.22741	7.35623

F LEVEL INSUFFICIENT FOR FURTHER COMPUTATION

DISCRIMINANT FUNCTIONS:

	FUNCTION			
	MALE UNSUCS	FEMALE UNSUCS	MALE ATTNOT	FEMALE ATTNOT
VARIABLE				
2	3.44752	3.15422	3.59987	2.80442
3	2.30892	2.38167	2.61614	1.75503
8	12.47638	12.68550	10.82966	13.05790
13	1.25668	1.55946	1.16761	1.91803
25	3.42153	2.74546	2.88265	2.79103
CONSTANT	-27.07698	-25.57219	-24.37171	-24.31509